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(12) **United States Patent**
Saxton et al.

(10) **Patent No.: US 7,506,591 B2**
(45) **Date of Patent: *Mar. 24, 2009**

(54) **CENTER BEAM CAR WITH DEPRESSED CARGO-CARRYING AREA**

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(73) Assignee: **Gunderson, Inc.**, Portland, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/095,911**

(22) Filed: **Mar. 31, 2005**

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US 2005/0166789 A1 Aug. 4, 2005

Related U.S. Application Data

(63) Continuation of application No. 10/706,898, filed on Nov. 13, 2003, now Pat. No. 6,883,437, which is a continuation of application No. 10/241,980, filed on Sep. 11, 2002, now Pat. No. 6,647,895, which is a continuation-in-part of application No. 10/022,601, filed on Dec. 17, 2001, now Pat. No. 6,523,484, which is a continuation-in-part of application No. 09/747,758, filed on Dec. 20, 2000, now Pat. No. 6,431,085.

(51) **Int. Cl.**
B61D 3/00 (2006.01)
B61D 25/00 (2006.01)

(52) **U.S. Cl.** **105/355**; 105/404

(58) **Field of Classification Search** 105/355, 105/404, 406.1, 416, 417, 418, 377, 422, 105/397, 399, 407, 413; 410/97, 32, 98, 410/100, 31, 35, 44, 45
See application file for complete search history.

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Thrall Car Mfg. Prototype care with reduced height center position, at least as early as Sep. 2000.

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Primary Examiner—S. Joseph Morano
Assistant Examiner—Robert J McCarry, Jr.
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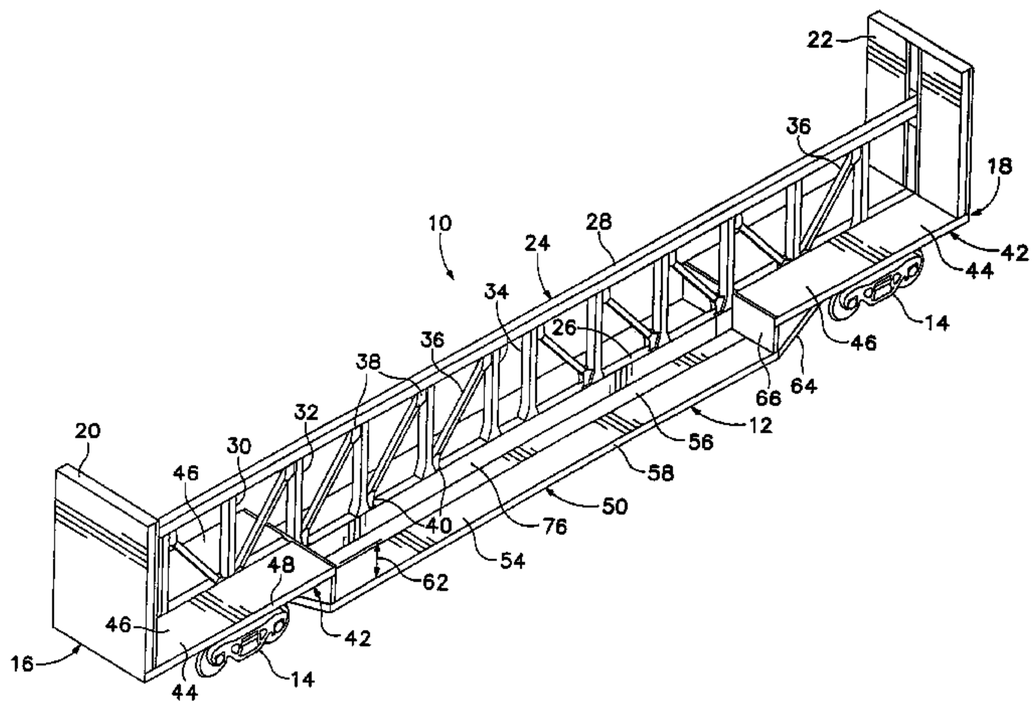
(57) **ABSTRACT**

A center beam railroad freight car including a cover for the lateral surfaces of the top chord of the center beam to reduce cargo damage, and wherein a bottom plate of a center sill of the car extends laterally as an inboard portion of a cargo-carrying floor.

10 Claims, 14 Drawing Sheets



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Prosecution History including all USPTO correspondence to Applicant and Applicant responses thereto, pertaining to U.S. Appl. No. 10/241,980 (now Patent No. 6,647,895), as of Aug. 1, 2008; pp. 1-29.

Prosecution History including all USPTO correspondence to Applicant and Applicant responses thereto, pertaining U.S. Appl. No. 10/022,601 (now Patent No. 6,523,484), as of Aug. 1, 2008; pp. 1-49.

Prosecution History including all USPTO correspondence to Applicant and Applicant responses thereto, pertaining to U.S. Appl. No. 09/747,748 (now Patent No. 6,431,085), as of Aug. 1, 2008; pp. 1-22.

Complete File History as of Jul. 24, 2008 for U.S. Appl. No. 10/706,898, filed Nov. 13, 2003, now Patent No. 6,883,437 issued Apr. 26, 2005; pp. 1-119.

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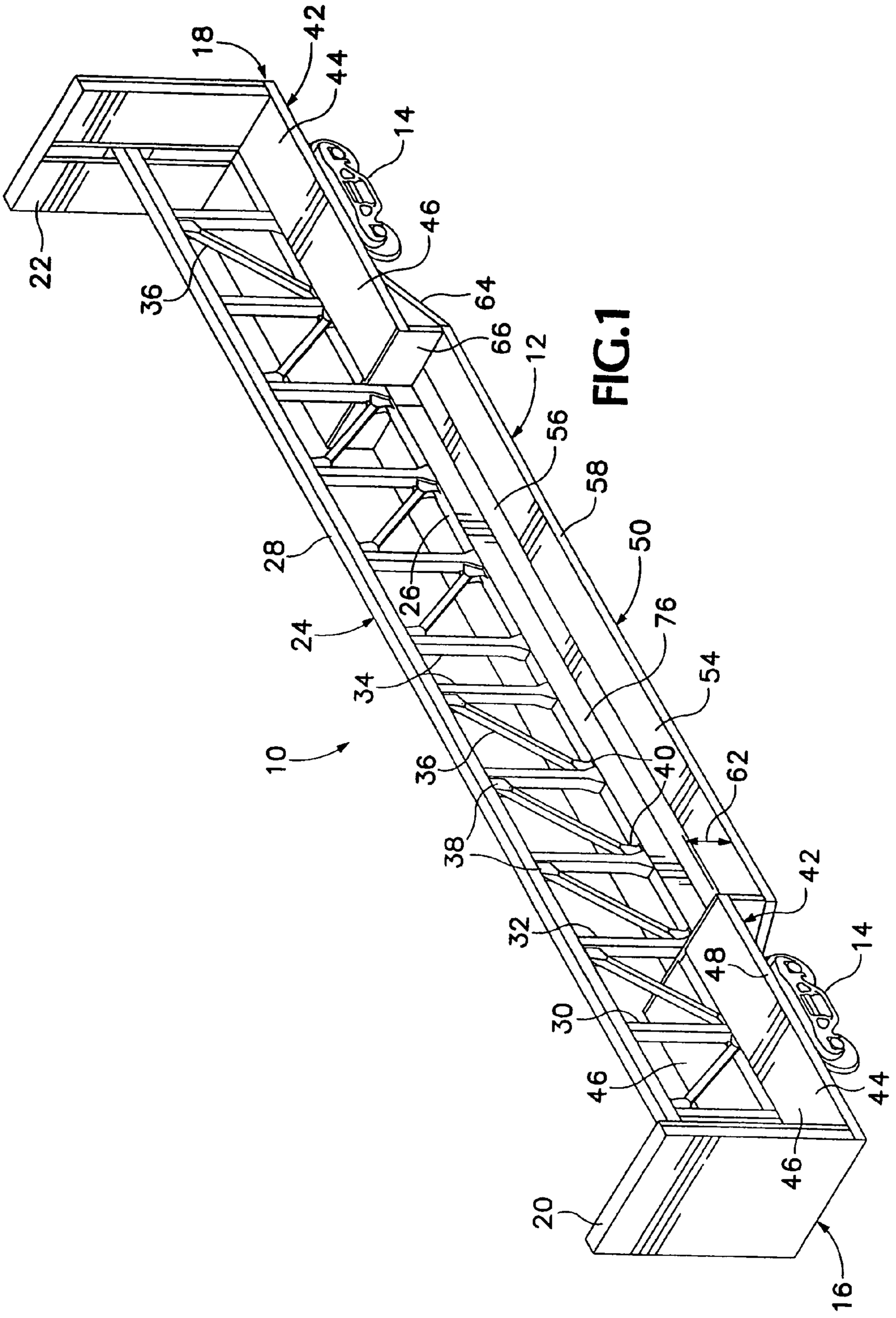
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FIG.1

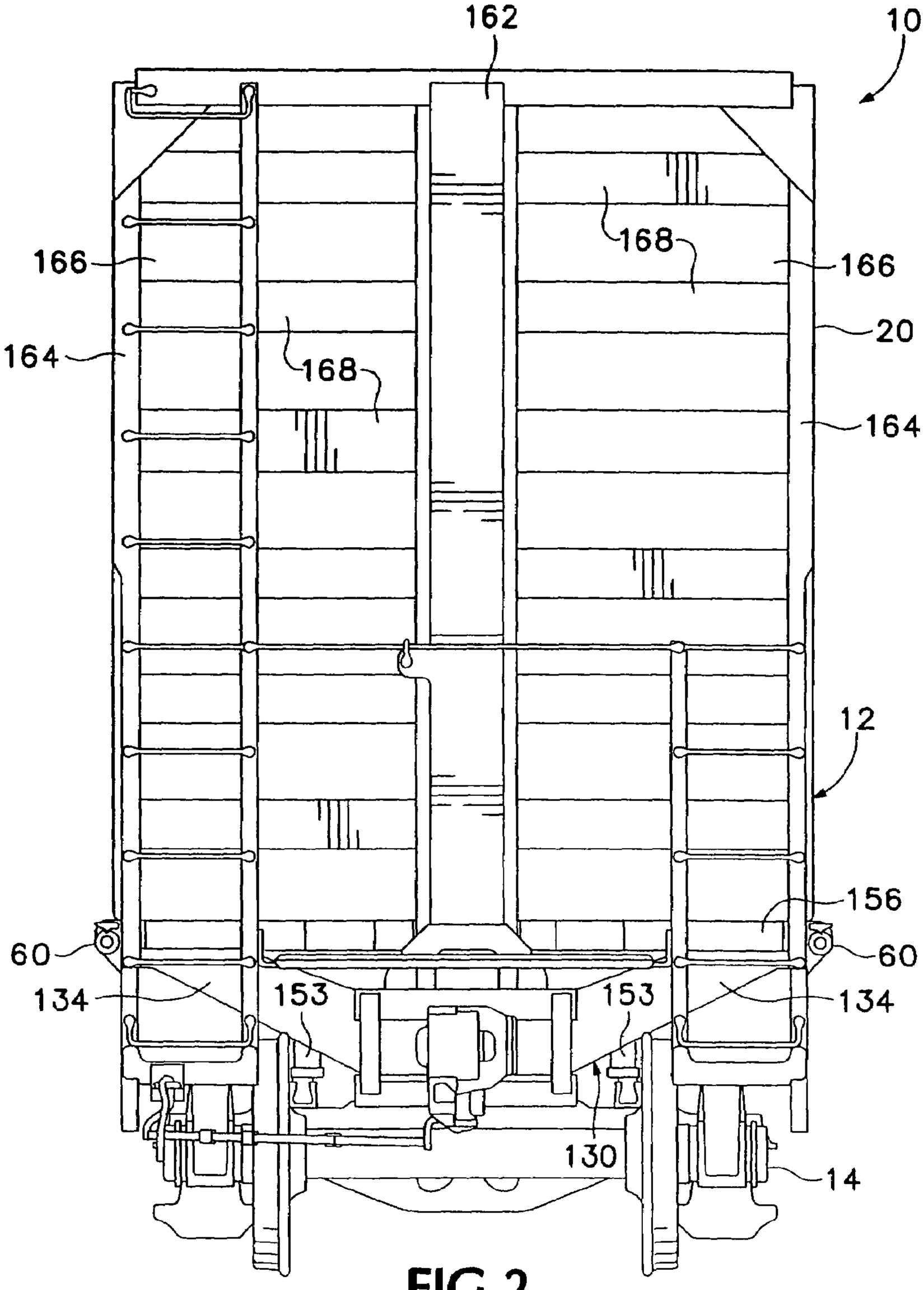
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FIG.2

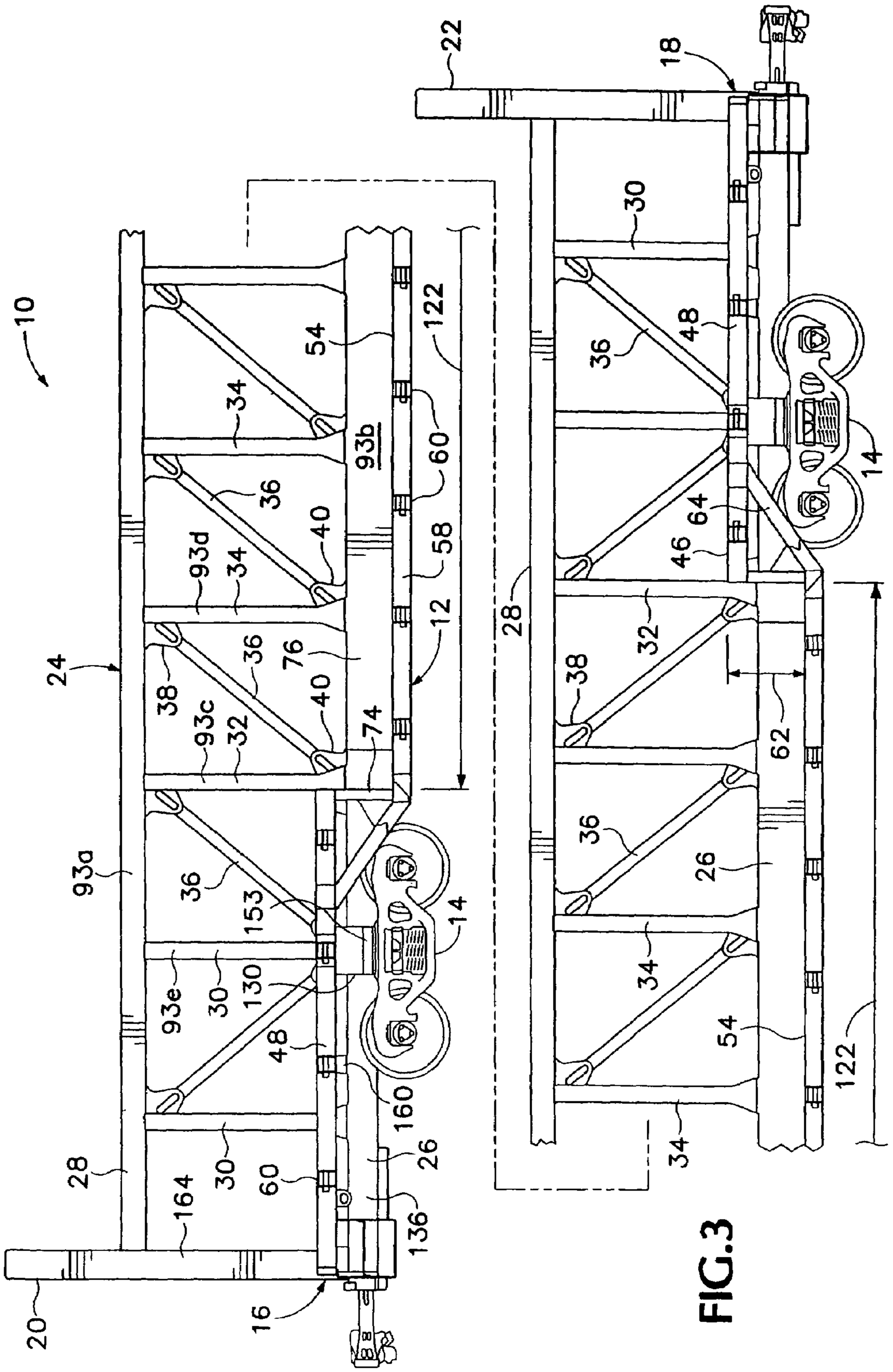
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FIG.3

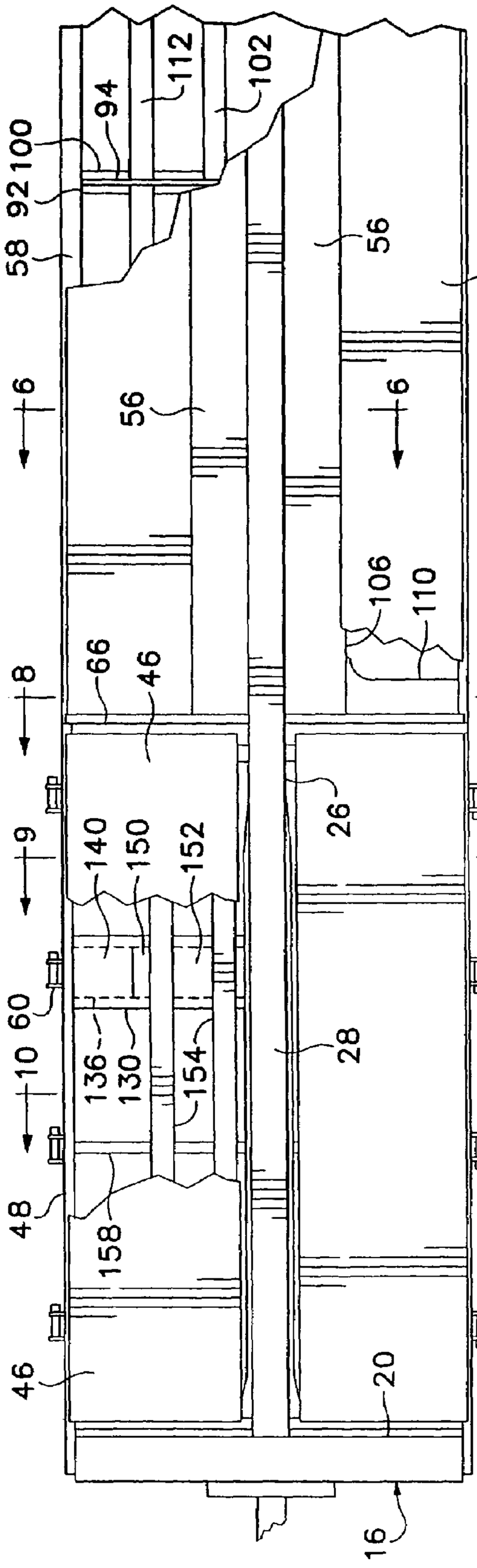
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FIG.4

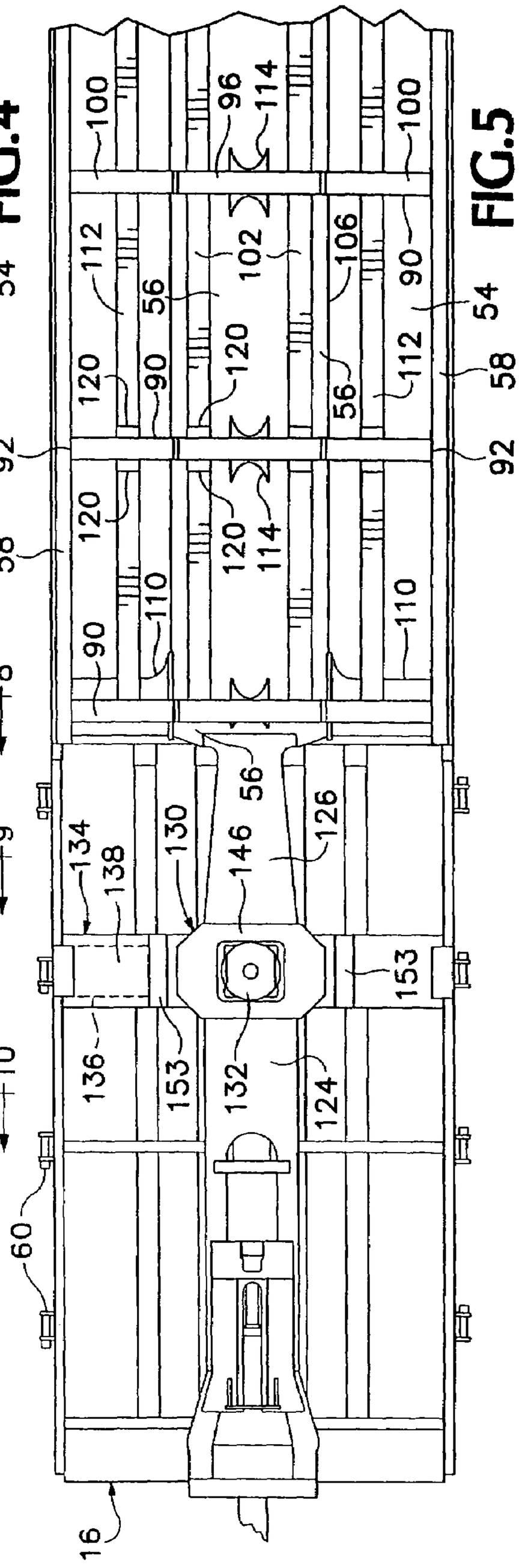
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FIG.5

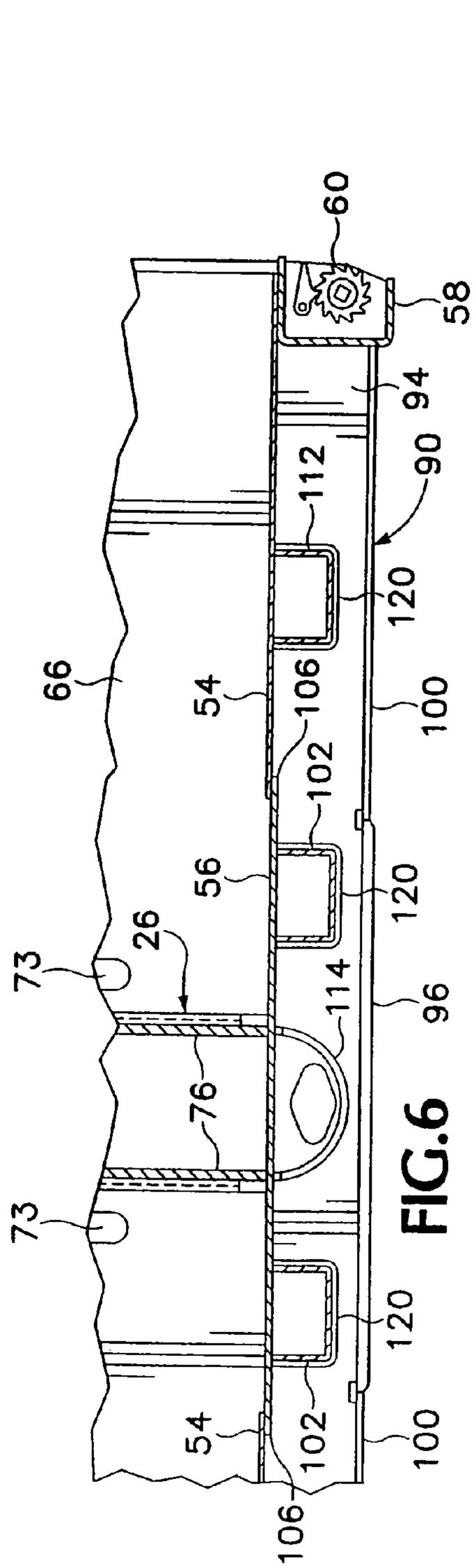
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FIG.6

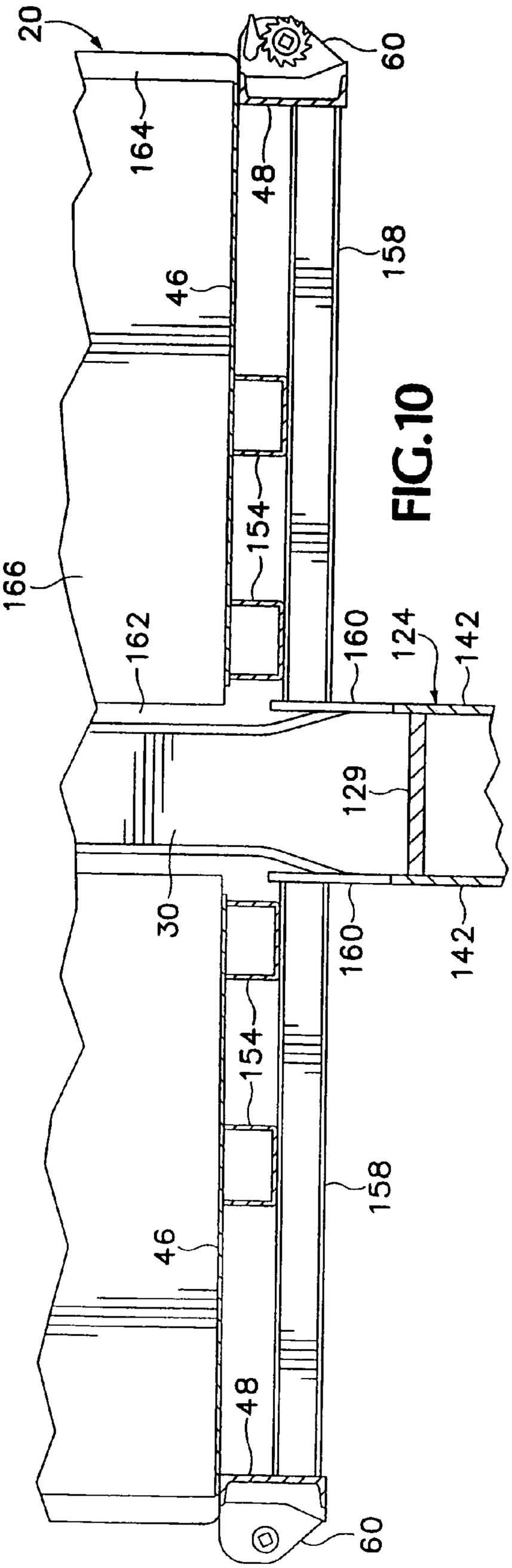
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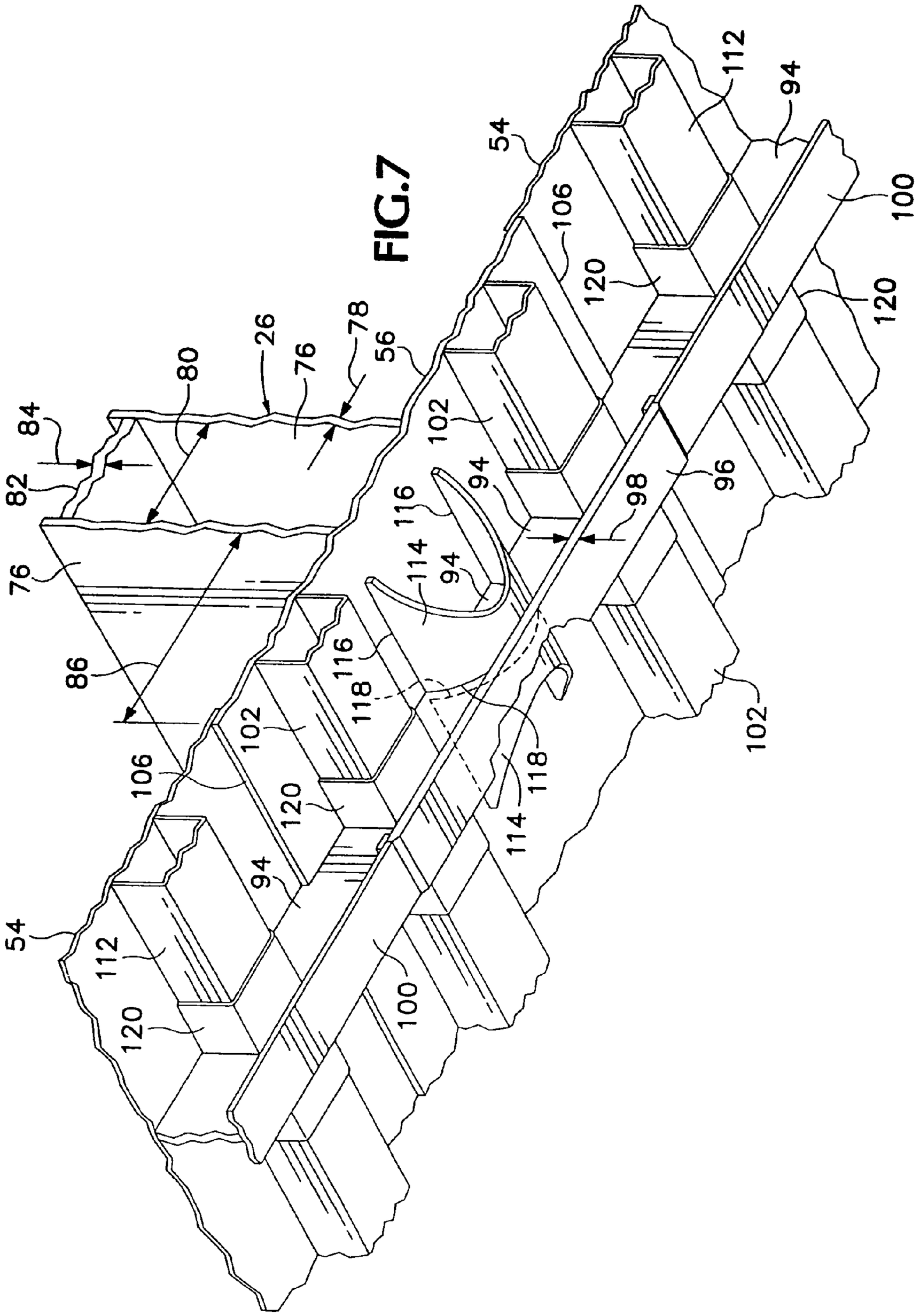
FIG.10

FIG.7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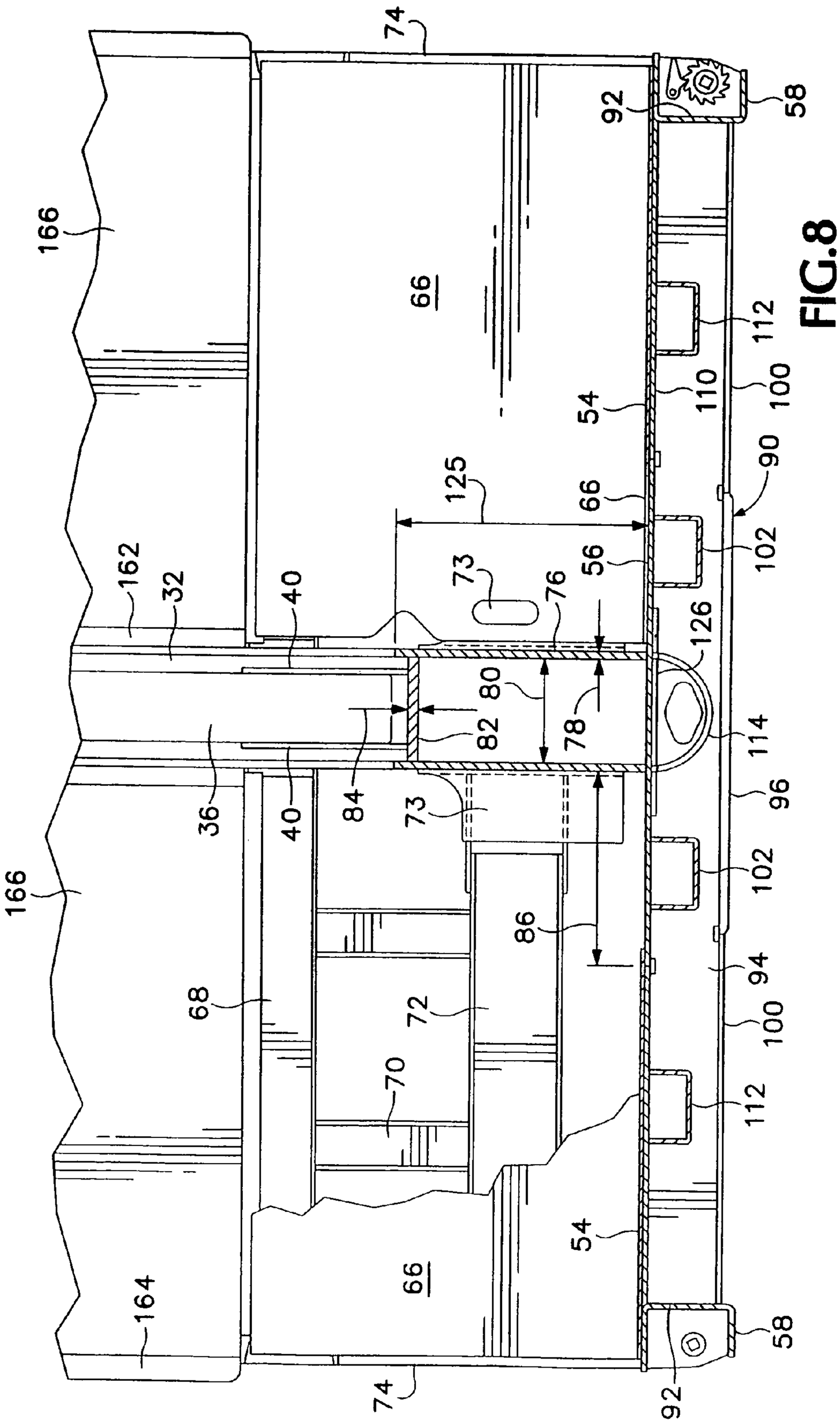
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FIG.8

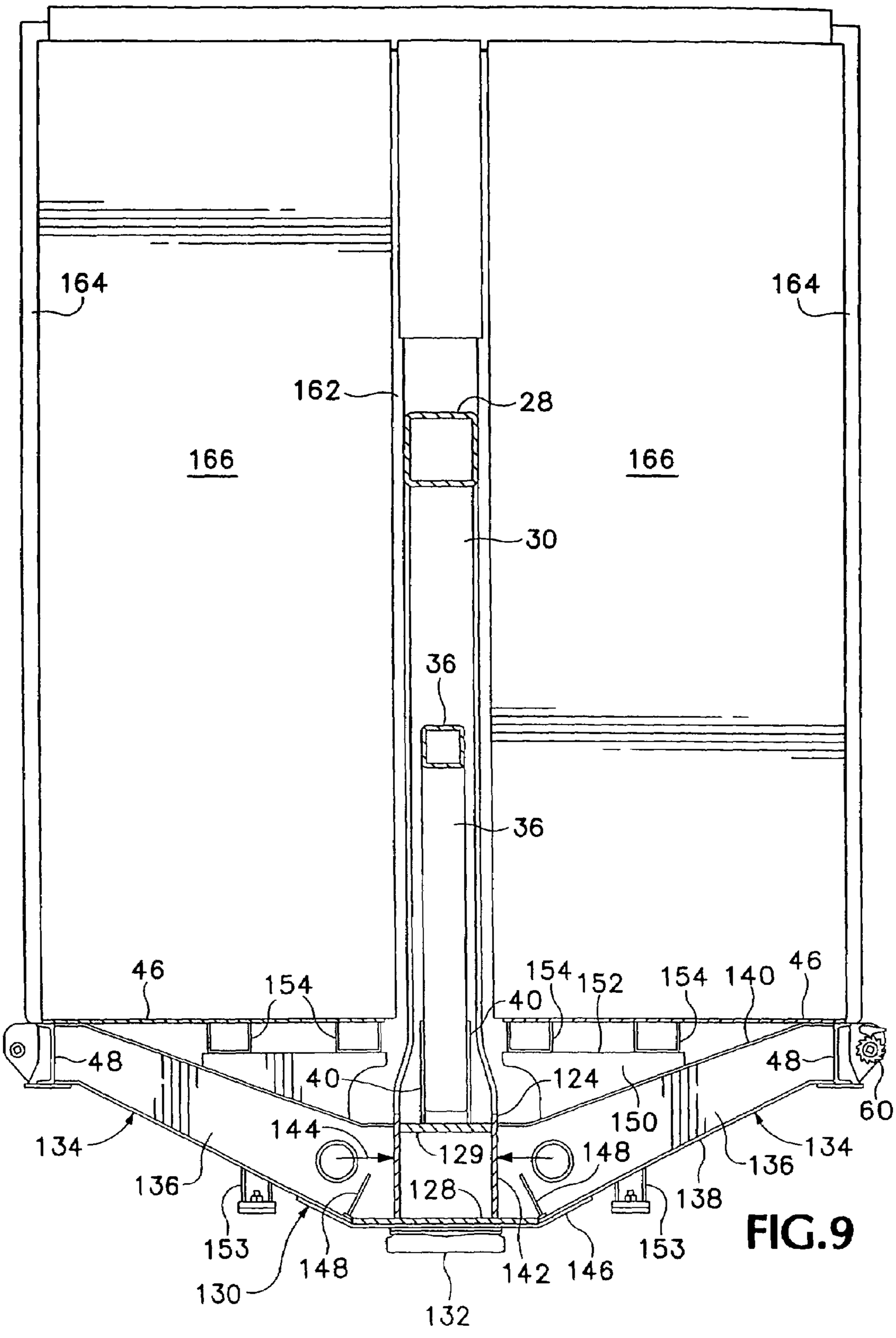
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FIG.9

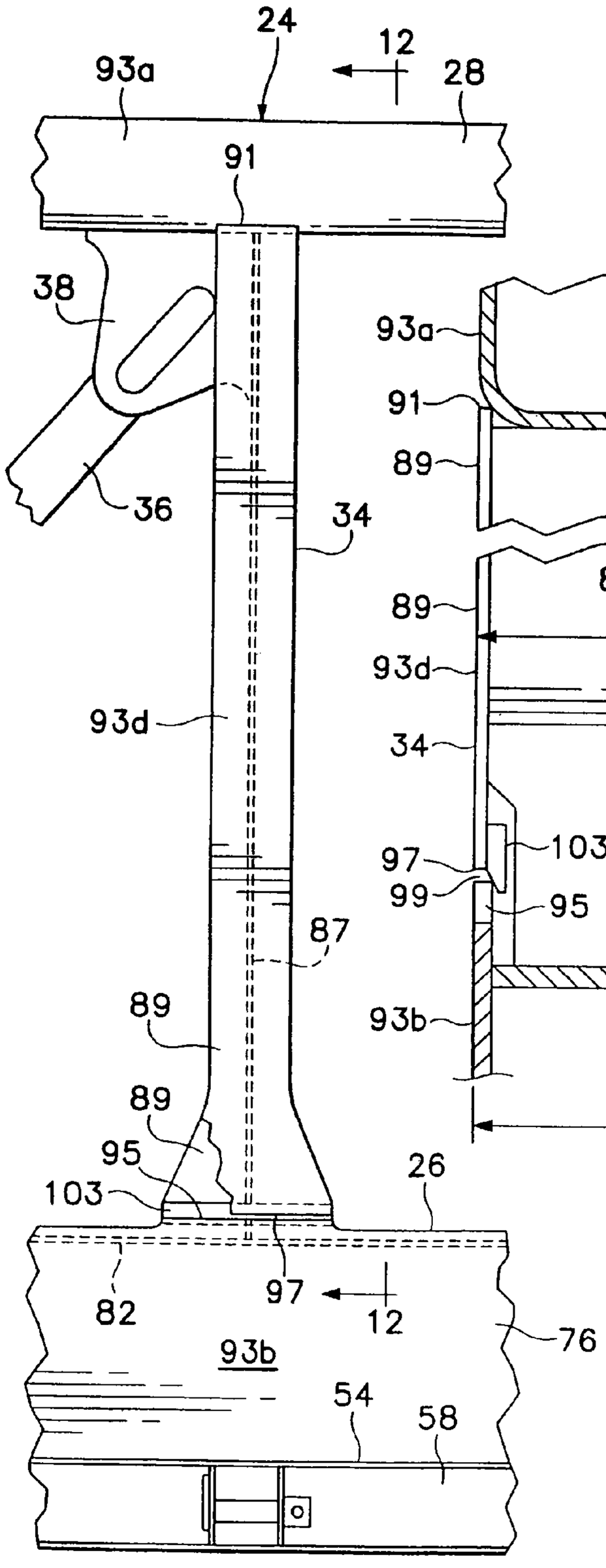
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FIG.11

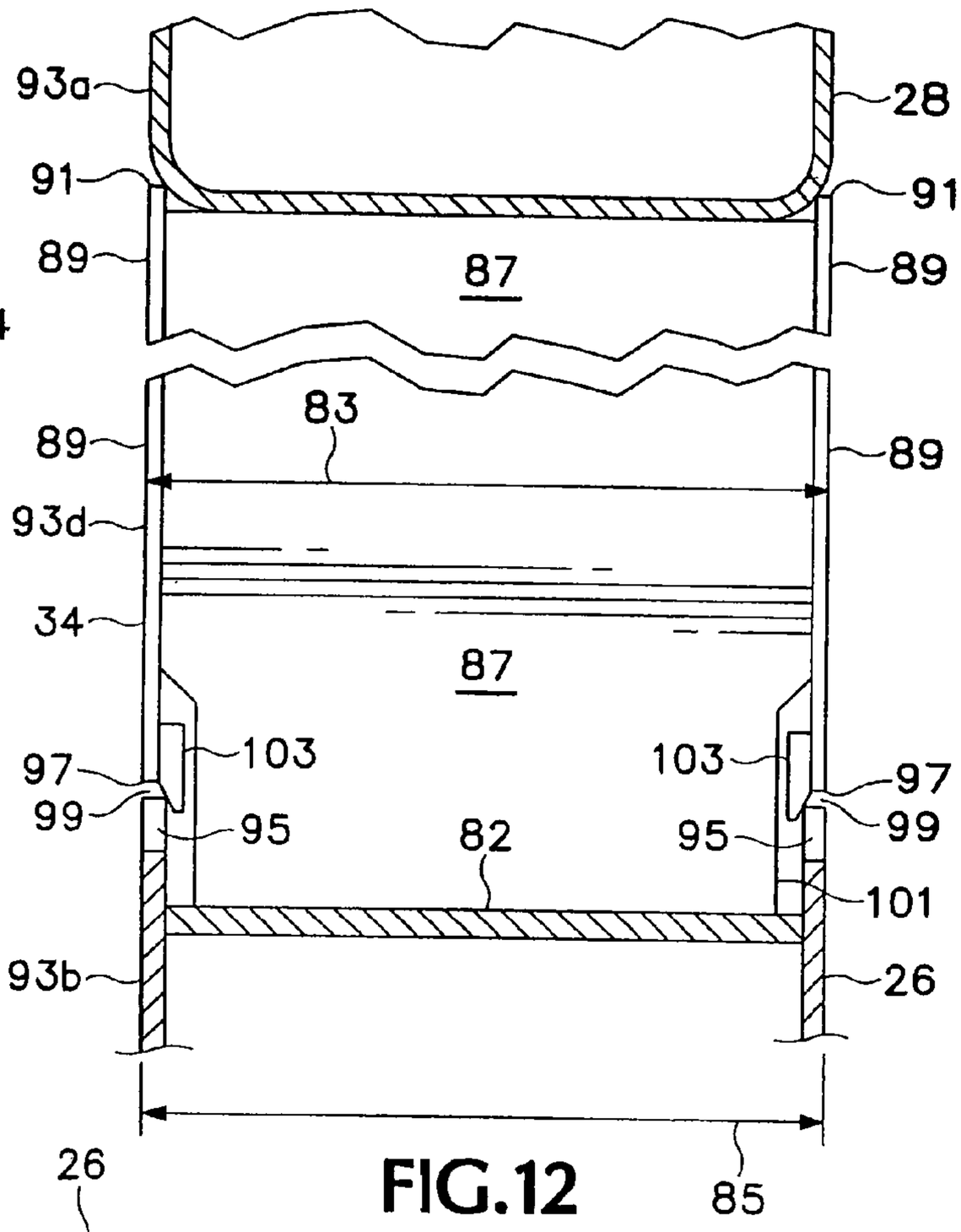
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FIG.12

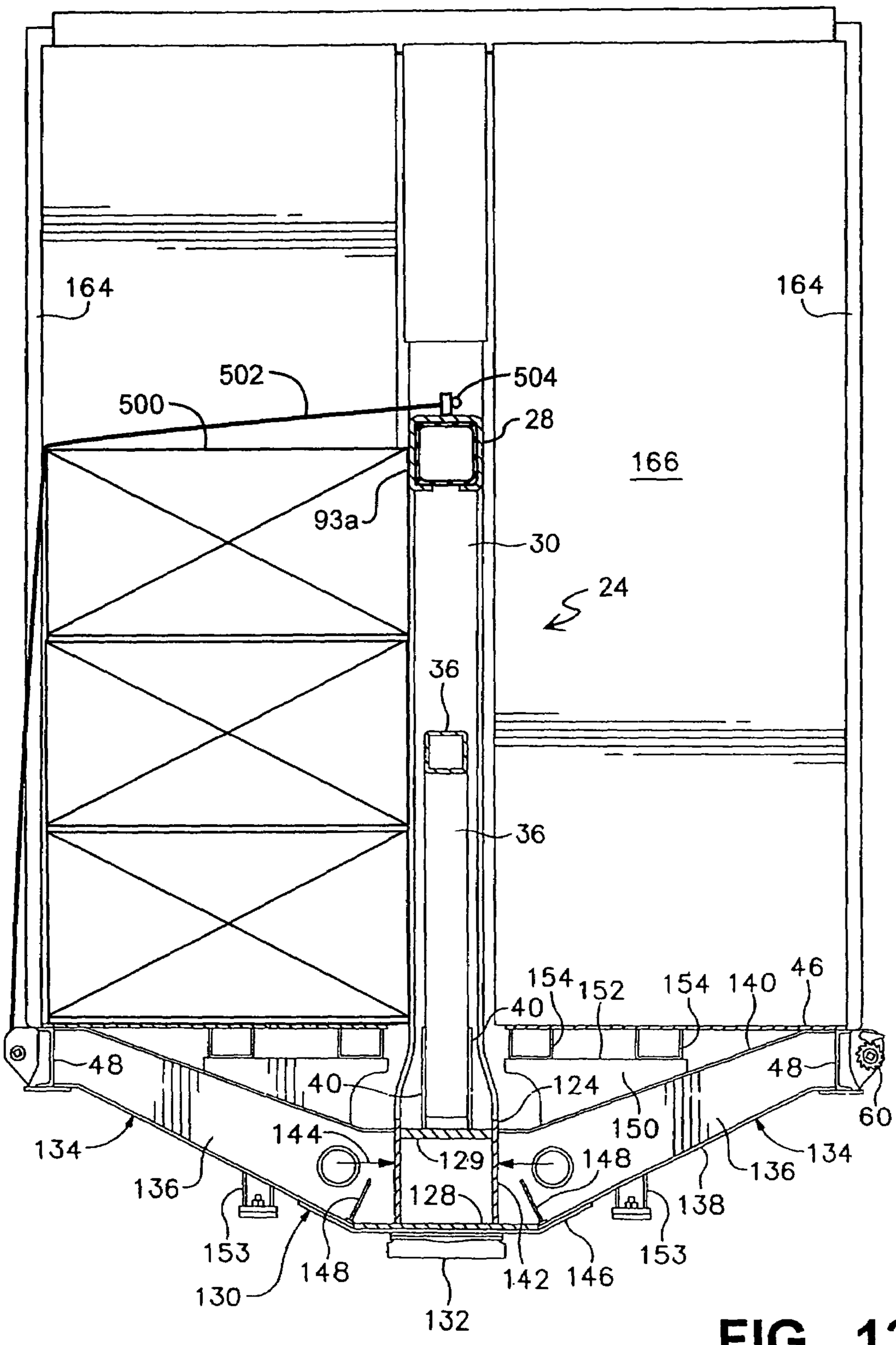
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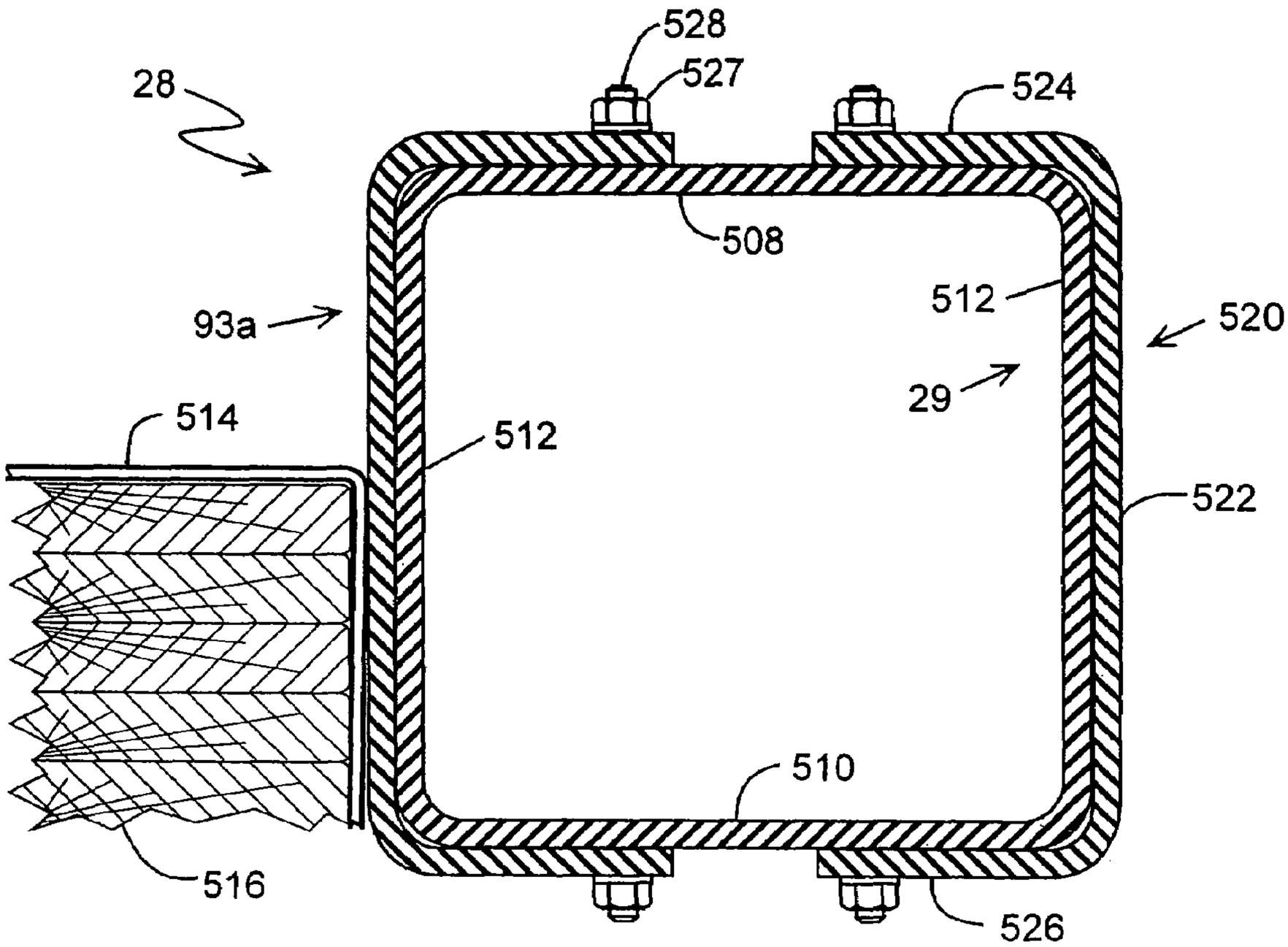
FIG. 13



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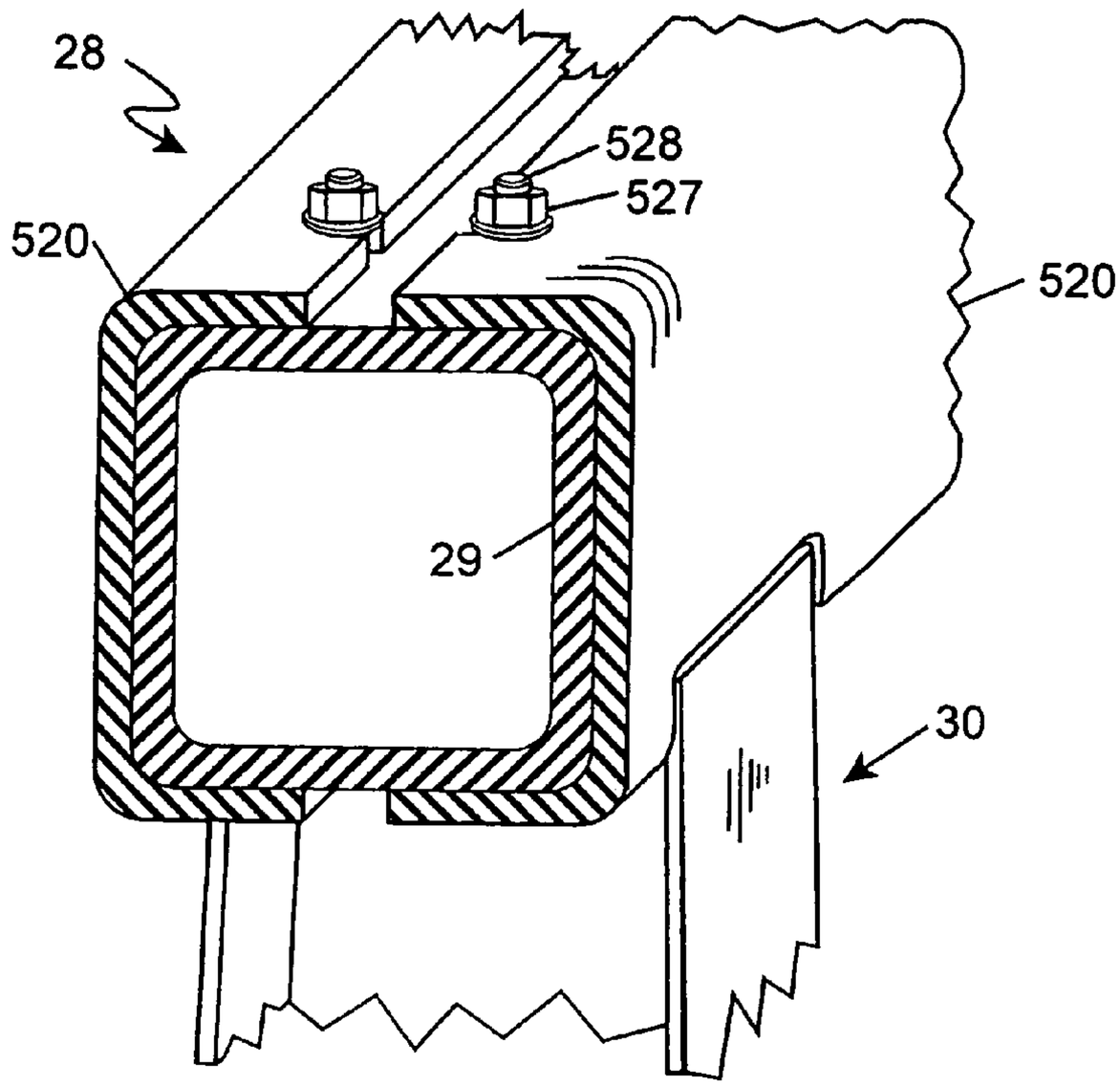

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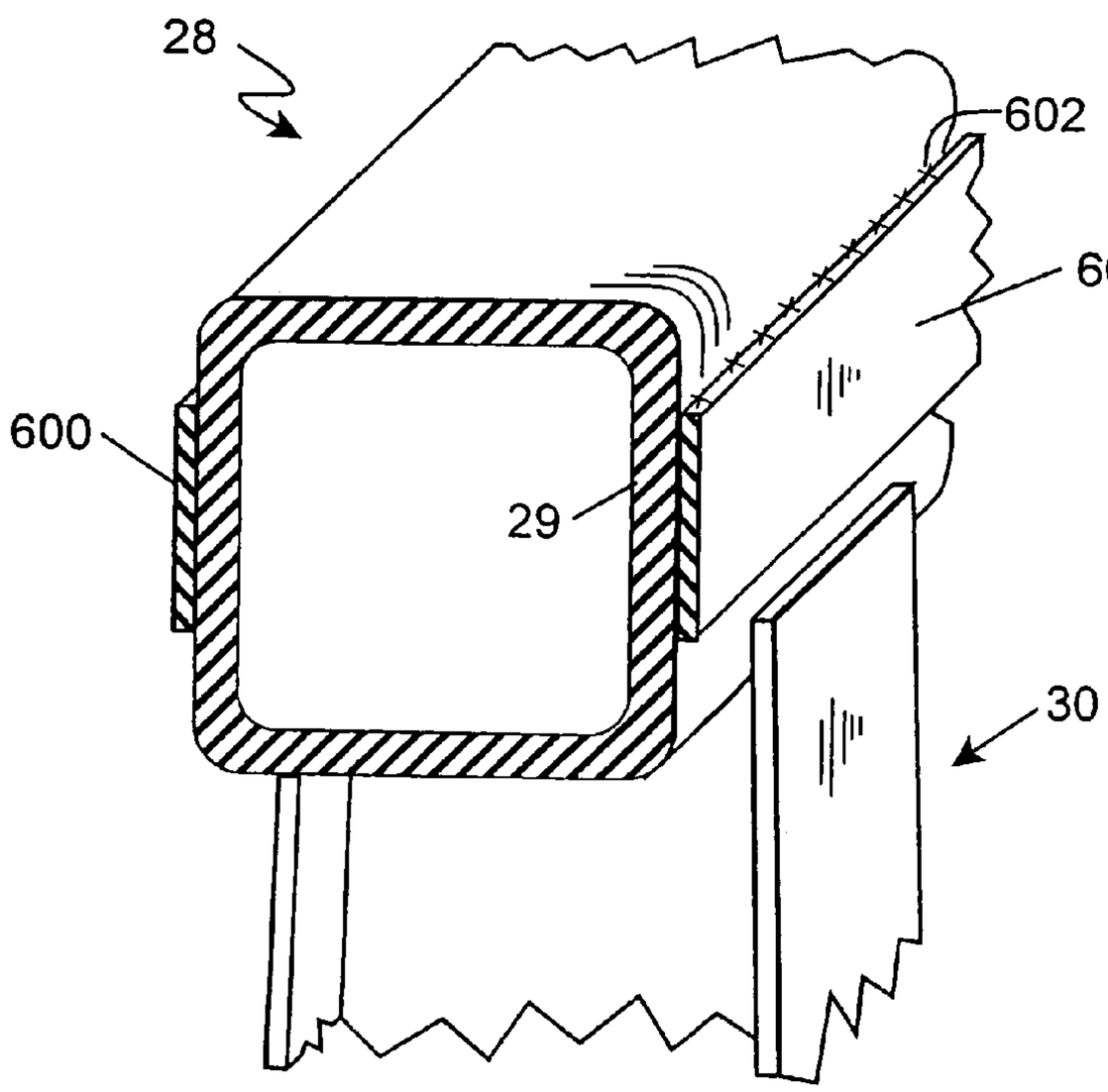

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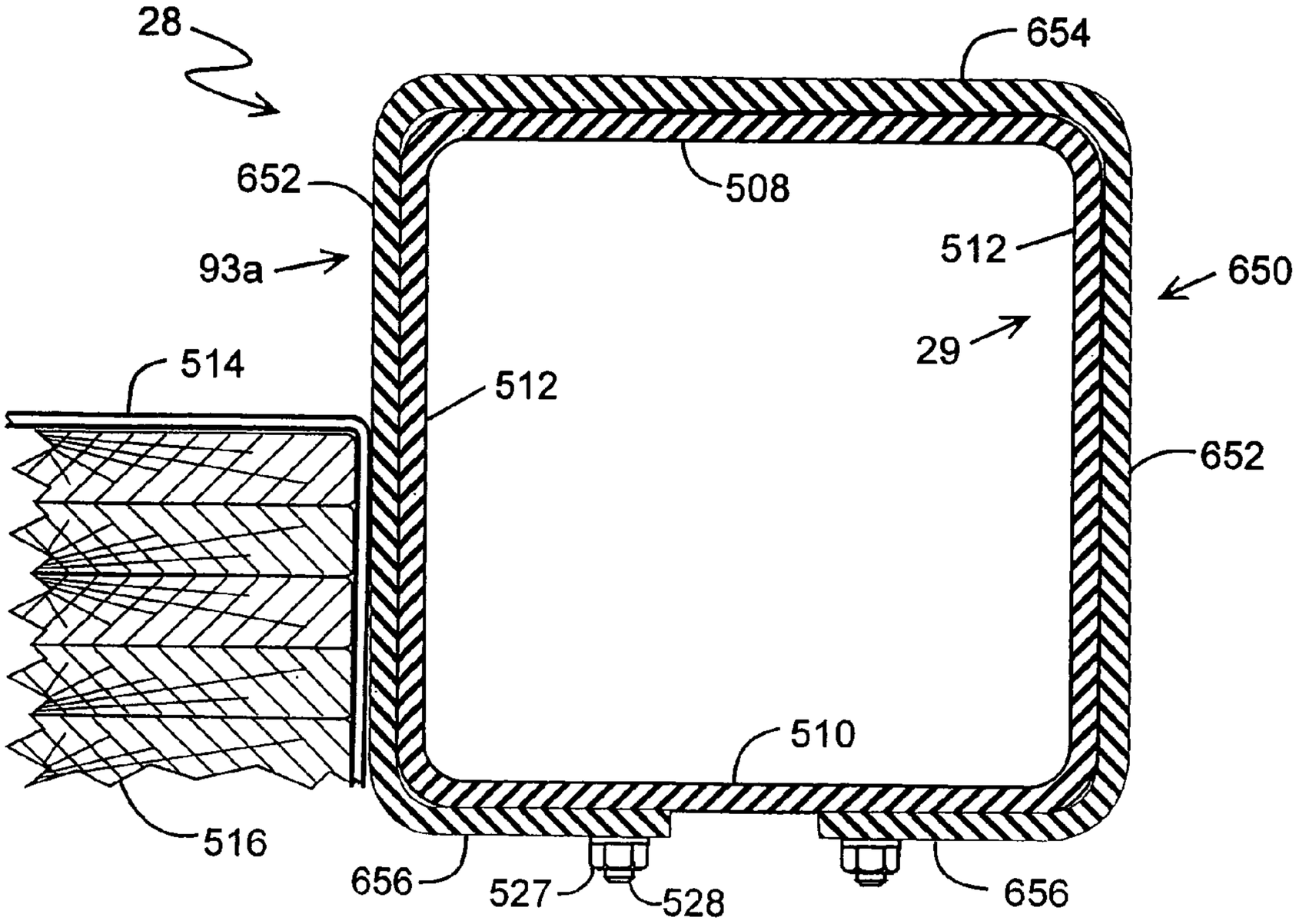
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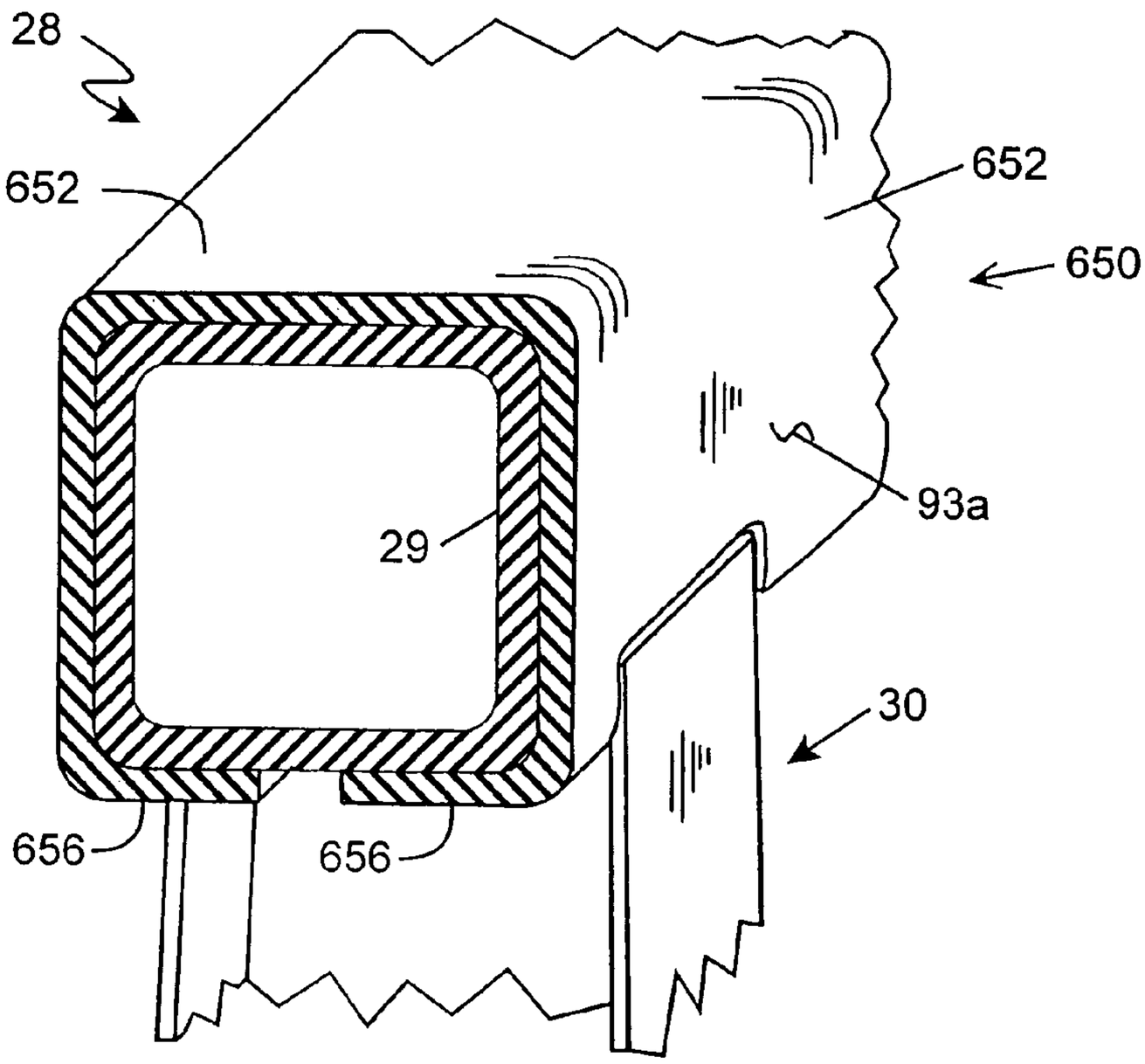
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FIG. 18

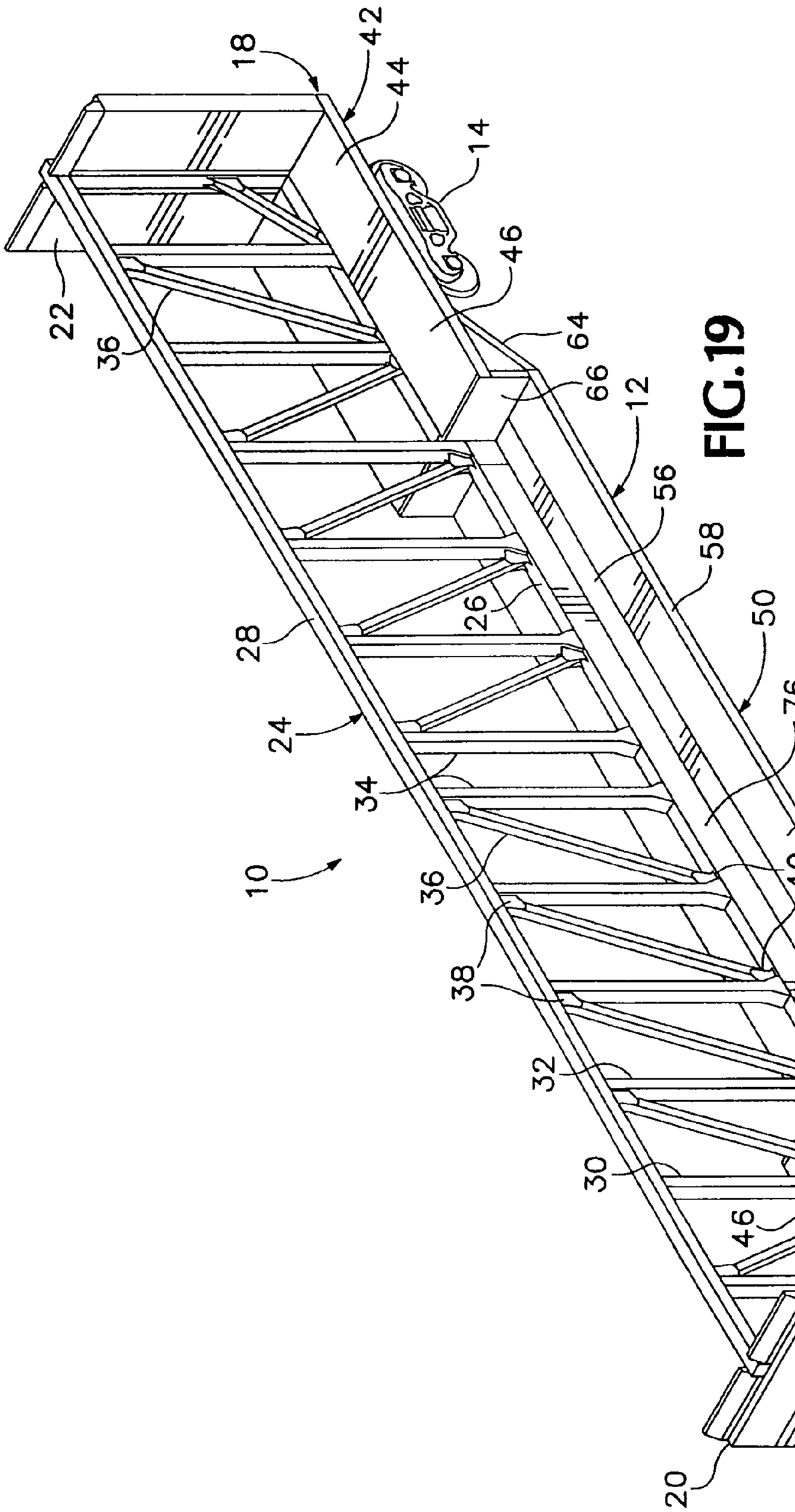
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FIG.19

CENTER BEAM CAR WITH DEPRESSED CARGO-CARRYING AREA

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of patent application Ser. No. 10/706,898, filed Nov. 13, 2003, now U.S. Pat. No. 6,883,437 which is a continuation of patent application Ser. No. 10/241,980, filed Sep. 11, 2002, now U.S. Pat. No. 6,647,895 which is a continuation-in-part of patent application Ser. No. 10/022,601 filed Dec. 17, 2001 now U.S. Pat. No. 6,523,484 which is a continuation-in-part of patent application Ser. No. 09/747,758, filed Dec. 20, 2000 now U.S. Pat No. 6,431,085.

BACKGROUND OF THE INVENTION

The present invention relates to freight-carrying railroad cars of the type known as center beam or center partition bulkhead flat cars, and in particular relates a center beam for a center beam car providing enhanced protection for the car's cargo.

Center partition bulkhead flat cars, commonly known as center beam cars, have been known for over 30 years and are depicted, for example, in Taylor U.S. Pat. No. 3,244,120, Wagner U.S. Pat. No. 3,734,031, Baker U.S. Pat. No. 4,543,887, and Saxton U.S. Pat. No. 5,758,584. Evolving design of such railroad cars has been directed generally toward cars with ample strength but of lighter tare weight in comparison to their cargo-carrying capacity. Construction of center beam cars of lighter weight with load-carrying floors located at a uniform height along the length of the car body leaves their load capacity limited by the available space.

Dominguez, et al., U.S. Pat. No. 4,951,575 discloses a center beam car in which a longitudinally intermediate portion of the load-carrying floor on either side of the center beam is located at a lower height than the load-carrying floors located in end portions of the car above the trucks on which the car body is carried. In the intermediate portion of such a car, crossbearers extend between lowered portions of the side sills of the car body and are supported beneath the center sill.

The car disclosed by Dominguez, however, has a conventional box-beam center sill structure, and the crossbearers of the car are attached to the center sill by hanger plates attached to the opposite sides of the center sill and extending downward to support an upper flange portion of each of the crossbearers. The structure of the car shown in the Dominguez et al. patent is thus unnecessarily heavy, making such cars expensive to build and operate.

In most previously available center beam cars the center of gravity has been relatively high because the entire load has been carried above the height of the trucks, but also at least partly as a result of the height of the center partition extending as high as the bulkheads on the ends of the car.

The space above the floor on each side of the center beam forms a bunk upon which bundles of cargo, typically wood products, can be stacked. When the bundles are stacked, they are typically secured by cables or straps that extend from a winch device mounted on the periphery of the floor to a top fitting on the center beam. When the cable or strap is tightened it exerts a force inwardly and downwardly so that the stack leans toward the longitudinal centerline of the car and is pulled tight against the center beam.

The bundles are often wrapped in a plastic sheet to protect the goods from rain and snow, and to discourage embedment of abrasive materials such as sand in valuable goods, such as wood. The plastic sheet typically comprises polyethylene, but may comprise another plastic material.

In previously known center beam cars, various components of the center beam are interconnected in such a manner as to present edges or fastening devices which could rub on the cargo. In addition, when the cables or straps are tightened, the innermost, uppermost elements of the topmost bundle bear against the top chord of the center beam. As the car moves, vibration and inertia cause the stacked cargo to move relative to the center beam. Exposed edges or fastening devices in the center beam structure often abrade, tear, or damage the protective plastic sheeting. Portions of the cargo bearing against the center beam can be physically damaged as a result of contact with exposed edges or projections. Moreover, damaged sheeting may permit entry and collection of moisture and dirt leading to discoloration and the growth of mold on wood products. The resulting loss of value for the cargo can be substantial.

Forbes, U.S. Pat. No. 6,237,506, discloses a smooth, non-consumable panel facing for a portion of the posts of a center beam. The smooth facing protects the plastic sheeting from tearing by reducing exposure to projections and sharp edges on the posts. However, a facing applied to the posts of the center beam does not protect the portion of the sheeting in contact with the top chord of the center beam. Abrasion induced by friction and relative movement of the cargo and the top chord can cause rapid failure of the plastic sheeting exposing the goods to a hostile environment.

What is desired, then, is a center beam or center partition bulkhead flat car defining greater useable cargo-carrying volume and having ample strength yet having lighter tare weight than previously available cars of the type, and in particular including improved center sill and crossbearer structures. What is further desired is a center beam car in which the center beam is constructed so as to be substantially free of edges and projections that can damage the cargo or its containers or coverings and in which the top chord is constructed so as to reduce damage resulting from relative movement of the car and its cargo.

SUMMARY OF THE INVENTION

The present invention responds to the aforementioned needs by providing a modified center partition bulkhead flat-car including a center sill extending longitudinally along the car's body, a center beam extending along the center sill with a top chord of the center beam spaced upwardly above the center sill and connected to it by upright members, and including crossbearers each attached to and extending transversely beneath the center sill and supporting a floor on each side of the car body, and wherein in an intermediate portion of the center sill located between the opposite ends of the car body, a bottom plate of the center sill extends laterally outward beyond the side plates of the center sill and acts as an inboard portion of the floor structure.

In one embodiment of this aspect of the invention the crossbearers are of inverted "T" construction including an upright web and a horizontal bottom flange, with a central portion of the flange, located beneath the center sill of the car, being thicker than outboard portions of the bottom flange.

In one embodiment of this aspect of the invention a stringer extends longitudinally along the underside of the bottom plate of the center sill.

A railroad car according to another aspect of the present invention includes an integrated center sill and floor structure in a portion of the body of the car in which the center sill includes a pair of center sill side plates spaced a first distance

apart from each other laterally, a center sill bottom plate extending along the bottom margins of the side plates and extending laterally outward beyond each of the side plates, a plurality of crossbearers interconnected with the center sill beneath the bottom plate, a floor sheet mounted atop the crossbearers and extending laterally outward from the bottom plate, and a stringer attached to the underside of the bottom plate at a location outboard from the pair of side plates of the center sill and extending longitudinally from one of the crossbearers to another, forming an integrated structure including the center sill and floor structure.

In one preferred embodiment of this aspect of the invention the crossbearers each include an upstanding web and a horizontal bottom flange forming an inverted T configuration and each crossbearer has opposite ends attached to side sills of the car.

In another preferred embodiment of this aspect of the invention a semi-cylindrical gusset interconnects the bottom plate of the center sill and the web of each crossbearer.

As another aspect of the invention a body bolster in a railroad car according to the present invention includes a pair of arms each extending laterally outward and diagonally upward from the center sill in an end portion of the car to a respective side sill, and a floor support riser is attached to an upper face of each arm of the body bolster and provides support for a floor sheet extending laterally inward from the side sill toward the center beam in the end portion of the car.

In a preferred embodiment of this aspect of the invention longitudinal floor support stringers are carried on a horizontal top face of the floor support riser.

In another aspect of the invention the center beam includes upright members which extend from the center sill to the top chord and which are attached in such a manner that the surfaces presented to cargo are coplanar and free of projections that could damage the cargo.

In another aspect of the invention, the top chord of the center beam comprises a selectively affixable, lateral face arranged to contact and resist lateral displacement of the cargo while facilitating movement of the cargo in directions generally parallel to the lateral face.

The foregoing and other objectives, features, and advantages of the invention will be more readily understood upon consideration of the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is an isometric view of a center beam railroad freight car embodying the present invention and including a car body in which a longitudinally intermediate portion includes cargo-carrying floors located at a lower height than cargo-carrying floors in the respective end portions of the car body.

FIG. **2** is an end elevational view of the center beam railroad car shown in FIG. **1**.

FIG. **3** is a side elevational view of the center beam railroad car shown in FIGS. **1** and **2**.

FIG. **4** is a top plan view of a portion of the center beam railroad car shown in FIG. **3**.

FIG. **5** is a bottom plan view of the portion of the center beam railroad car shown in FIG. **4**.

FIG. **6** is a sectional view of a portion of the railroad car shown in FIG. **4**, taken along line **6-6**.

FIG. **7** is an isometric view of a portion of the center sill and floor structure of the center beam railroad car shown in FIGS. **1-6**, taken from the underside of the intermediate portion thereof.

FIG. **8** is a partially cutaway sectional view of the center beam railroad car shown in FIG. **4**, taken along line **8-8**.

FIG. **9** is a sectional view of the center beam railroad car shown in FIG. **4**, taken along line **9-9**.

FIG. **10** is a sectional view of the center beam railroad car shown in FIG. **4**, taken along line **10-10**.

FIG. **11** is a side elevational view showing the manner in which a column is interconnected with the center sill and the top chord in the intermediate portion of the center beam railroad car shown in FIG. **3**, at an enlarged scale.

FIG. **12** is a sectional view, taken along line **12-12** of FIG. **11** at an enlarged scale, showing the interconnection of the vertical column with the center sill and the top chord tube.

FIG. **13** is a sectional view of the center beam railroad car shown in FIG. **4**, taken along line **9-9** and illustrating placement of cargo on the car.

FIG. **14** is a sectional view of the top chord of the center beam of the railroad car shown in FIG. **4**, taken along **9-9**.

FIG. **15** is a perspective view of a portion of the center beam top chord illustrated in FIG. **14**.

FIG. **16** is a perspective view of a top chord and another embodiment of a top chord cover.

FIG. **17** is a sectional view taken along **9-9** of the top chord of a center beam of the railroad car and a top chord cover of still another embodiment.

FIG. **18** is a perspective view of the top chord and the embodiment of the top chord cover illustrated in FIG. **17**.

FIG. **19** is an isometric view of a center beam railroad freight car which is another embodiment of the present invention and includes a car body in which a longitudinally intermediate portion includes cargo-carrying floors located at a lower height than cargo-carrying floors in the respective end portions of the car body and in which the top chord of the center beam is at a height proximate the tops of the bulkheads.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawings which form a part of the disclosure herein, as may be seen in FIG. **1**, a center beam car **10** embodying the present invention has a car body **12** of welded steel construction carried on a pair of wheeled trucks **14** located at respective opposite ends **16** and **18** of the car body **12**.

Bulkheads **20**, **22** are located at the opposite ends **16** and **18**, and a center beam **24** extends longitudinally of the car body **12** between the bulkheads **20** and **22**.

Referring also to FIGS. **2** and **3**, the car body **12** includes a center sill **26** that extends from the first end **16** to the other end **18**. The center sill **26** acts as part of the bottom chord or flange of the center beam **24**. A top chord **28** of the center beam extends longitudinally along the car body **12** a distance above and parallel with the center sill **26** from the bulkhead **20** to the bulkhead **22**, and is attached structurally to each of the bulkheads **20** and **22**. While the top of the center beam **24** is shown as having a height less than that of the tops of the bulkheads **20** and **22**, the car **10** could also be constructed with a center beam **24** of greater height, at least up to nearly as high as the tops of the bulkheads **20** and **22**, as illustrated in FIG. **19**.

Vertical columns **30**, **32** and **34** in the form of fabricated I-beams extend upward from the center sill **26** to the top chord

28 as the web of the center beam 24. The top chord 28 may, for example, comprise 10"×10" square tubing 29 of ½-inch wall thickness. The lower ends of the columns 30 are flared outward to be broader than the upper portions of the columns, and to match the width of the center sill 26 at the location where each is attached to the center sill 26. The upper portions of the columns 30, 32, and 34 are, for example, of welded steel plate.

The vertical columns 30, 32 and 34 are attached to the center sill 26 with ample strength and in such a way that the surfaces presented to the cargo where they are attached are smooth and free of edges or projections that could damage cargo, as will be explained in greater detail presently.

Square tubular diagonal members 36 are somewhat smaller than the columns 30, 32, and 34 and are attached to respective ones of the columns and to the center sill 26 and top chord tube 29 by upper end gusset plates 38 and lower end gusset plates 40 welded into place on each side of each diagonal member 36. The gusset plates 38 and 40 are welded to the transverse web plates of the respective columns, as well as to the top of the center sill and the underside of the top chord tube 29.

Each of a pair of end portions 42 of the car body 12 includes the respective bulkhead 20 or 22 and extending beyond the respective truck 14. A generally horizontal upper level cargo floor 44 is located alongside the respective columns 30 on each lateral side of the center beam 24 in each end portion 42. The floor 44 in each end portion 42 includes a floor sheet 46 on each of the laterally opposite sides of the center beam 24. Each floor sheet 46 extends along and is attached to a respective end portion side sill 48, as will be explained more fully below.

An intermediate portion 50 of the car is located between the two end portions 42. The intermediate portion 50 includes a depressed cargo-carrying floor located on each lateral side of the center beam 24 at a significantly lower height than that of the upper level cargo floors 44 in each of the end portions 42. Whereas the floor sheets 46 are located at a height above the top of the center sill 26, floor sheets 54 of the depressed floor extend in substantially coplanar alignment with a bottom plate 56 of the center sill 26, as is shown most clearly in FIG. 6, so that cargo carried in the intermediate portion 50 can be placed alongside and in contact with the center sill 26.

An outboard margin of each floor sheet 54 is attached to and supported by a respective intermediate portion side sill 58, which may be a channel with unequal flanges of bent plate construction, as is seen best in FIG. 6. Preferably, the side sill 58 channel is formed of 5/16 inch steel plate, and has its flanges facing outboard to provide a protected location for cargo tie-down strap spools 60 in the intermediate portion 50 of the car body 12.

A height difference 62 between the floors 44 and the floor sheets 54, shown in FIGS. 1 and 3, is preferably equal to or a multiple of the usual height of a package of goods, for example a bundle of plywood, intended to be carried on the center beam car 10. For example, the height difference 62 may preferably be about 33 inches, equal to the height of a bundle of plywood including its packaging and leaving room for stickers providing clearance beneath the plywood for the forks of a forklift truck or other cargo-handling equipment.

A floor support transition portion of the car body 12 includes diagonal structural members 64, which may be channels, and a shear plate 66 located on each side of the center sill 26 and supported by stiffening channel structures 68, 70 and 72. Reinforcing angles 73 seen in FIGS. 6 and 8 assist in reinforcing the shear plates 66 and connecting the shear plates 66 with the side plates 76 of the center sill 26. Transitional side posts 74 on each side of the car body interconnect the upper, or end portion side sills 48 with the intermediate portion side sill 58.

Referring now to FIGS. 4, 5, 6 and 7, in the intermediate portion 50 of the car body 12, the center sill 26 is integrated with the structure of the floors on either side of the center sill. As shown best in FIG. 6, the center sill 26 in the intermediate portion 50 of the car includes a pair of parallel upright side plates 76 having a thickness 78 of, preferably, 5/16 inch plate, extending longitudinally and spaced apart laterally by a distance 80 of, for example, 9⅜ inches. A top plate 82 spans the distance 80, for example, between the upright side plates 76 and interconnects them near an upper margin of the center sill, as may be seen in FIG. 6. The top plate 82 has a thickness 84 that is greater than the thickness 78 of each side plate 76. For example, the thickness 84 may be ⅜ inch.

The bottom plate 56 is welded to the bottom margins of the side plates 76 and extends horizontally outward beyond the side plates 76 by a distance 86 of, for example, 16 inches, on each side of the center sill 26, so that the center sill 26 in the intermediate portion 50 of the car body 12 thus has the form of a closed rectangular box with a laterally extending flange on each side of its bottom face. The bottom plate 56 preferably has a thickness 88 which is similar to the thickness 78 of each side plate 76. For example, the thickness 88 is preferably 5/16 inch. The distance 86 should be at least half the distance 80 and is preferably greater than the distance 80, so that the bottom plate 56 includes ample material to carry the forces developed in the bottom of the center beam 24, although the weight of the bottom plate 56 is spread laterally. The bottom plate 56 thus is available to act as a portion of the cargo supporting floor structure and to aid in providing stiffness of the center sill to resist lateral bending in the intermediate portion 50 of the car 10.

As shown best in FIGS. 11 and 12, the columns 30, 32 and 34 extend upward from the center sill 26 to the top chord 28. While only a single column 34 is shown in FIGS. 11 and 12, the interconnections of the columns 30 and 32 with the top chord 28 and the center sill 26 are similar except at the bottom of columns 30 (shown in FIGS. 9 and 10). The columns 32 and 34 each have a width 83 equal to the width 85 of the center sill 26 in the intermediate portion 50 of the car 10, and are constructed as fabricated I-beams each having a transverse web plate 87 fitting between a pair of flange, or side, plates 89 extending vertically and longitudinally and aligned with the side plates 76 of the center sill 26. The upper end 91 of each of the columns is welded to the underside of the top chord tube 29, as seen best in FIG. 12, to present a continuous planar surface including one lateral face 93*a* of the top chord 28.

Each of the side plates 76 of the center sill 26 includes upwardly projecting portions 95 whose lengths and locations along the center sill 26 correspond with the bottom margins 97 of the flange plates 89 of the columns 30, 32, and 34, as may be seen in FIGS. 3 and 11. Each of the flange plates 89 of each column includes a broad bottom margin 97 to provide ample material to be welded to the center sill 26. Above the bottom margin 97 each flange or side plate 89 is tapered to a narrower width that continues for the majority of the length of each column. Each flange plate 89 is located above, and is aligned with, an upwardly projecting portion 95 of a respective side plate 76 of the center sill 26 so that the respective laterally outer faces 93*a*, 93*b*, 93*c* and 93*d* of the top chord 28, the center sill 26, and each of the columns 32 and 34, are all coplanar with each other on each lateral side of the center beam 24 in the intermediate portion 50 of the car 10. The lateral faces 93*e* of the portions of each column 30 above the

end portion floors **44** are similarly coplanar with the lateral faces of columns **32** and **34** and the top chord **28**.

The lower end of each of the columns **32** and **34** is welded to the top of the center sill **26** as shown in FIG. **12** to provide a connection with ample strength and a joint surface free from exposed edges or projections that might catch or cause wear on the surfaces of cargo or packaging. The lower end of the central web plate **87** is welded to the top of the top plate **82** of the center sill **26**, preferably leaving a small gap **99** between the bottom margin **97** of each flange plate **89** and the adjacent projecting portion **95** of the side plate **76**. A portion of each side of the web plate **87** is cut out as shown at **101**, leaving room for a backing bar or doubler plate **103** to be attached flush against the inner face of each flange plate **89** where the bottom margins **97** of the flange plates **89** face the projecting portions **95** of the side plates **76**.

The doubler or backing bar **103** is ideally of bar stock whose thickness is similar to that of each of the side plates **76**. Each backing bar or doubler plate **103** has a chamfered bottom surface that bridges the gap **99** and accounts for the difference in thickness between side plates **76** of the center sill **26** and the thinner flange plates **89** of the column **32** or **34**. The backing bar **103** thus supports and adds strength to the welded connection between the bottom margins **97** of the flange plates **89** and the side plates **76**, while permitting the outer surface of the interconnecting weld to be smooth and coplanar with laterally outer faces of the side plate **76** and the flange plate **89**.

In order to support the cargo-carrying floor in the intermediate portion **50** of the car at the relatively low height of the bottom plate **56**, lower than the height of the tops of the wheels of the trucks **14**, several crossbearers **90** extend transversely beneath and are attached to the center sill **26**. Each of the opposite ends **92** of each crossbearer **90** is welded to the respective side sill **58**. Each crossbearer **90** includes an upstanding web member **94** and a horizontal bottom chord or flange of which a central portion **96** is of relatively thick steel plate, having a thickness **98** of, for example, ⅝ inch. Outboard portions **100** of the flange of the crossbearer **90** are preferably of thinner material such as steel plate 5/16 inch thick, which is amply strong for the loads imposed, while the greater thickness **98** of the central portion **96** of the flange is desirable to carry the compressive loads imposed by the weight of the lading carried on the car **10**.

The web **94**, like the outboard portions **100**, is similarly of thinner material such as sheet or plate material ¼ inch thick, and the upper margin **104** of the web **94** is welded to the underside of the bottom plate **56**.

A pair of stringers **102** extend longitudinally along the underside of the laterally extending, or outboard, portions of the bottom plate **56** of the center sill **26**, providing stiffening support and helping to stabilize the interconnection of the webs **94** of the crossbearers **90** with the bottom plate **56**.

Each floor sheet **54** overlaps the respective longitudinally extending side margin **106** of the bottom plate **56** by a small distance and is welded to it. The floor sheet **54** extends outboard and has its outboard margin welded to the side sill **58**, whose upper flange forms the outboard-most portion of the cargo-carrying surface of the floor in the intermediate portion **50** of the car **10**.

At each end of the intermediate portion **50** of the car body **12** an extension plate **110** extends laterally beneath the floor sheet **54**, from the outward margin of the bottom plate **56** to the side sill **58**, as may be seen in FIGS. **4**, **5** and **8**. The web **94** of the crossbearer **90** at each end of the intermediate portion **50** of the car is thus attached to the underside of each of the plates **110**, as shown in FIG. **8**.

Extending parallel with the stringers **102** are stringers **112** attached to the underside of the floor sheets **54** and to the webs **94** of the crossbearers **90**. The floor sheets **54** are preferably of material significantly thinner than the material of the bottom plate **56** of the center sill. For example, the floor sheets **54** may be of **11** gauge sheet steel, i.e., 0.1196 inch in thickness, but they are supported by the bottom plate **56**, the side sills **58**, the webs **94** of the crossbearers **90**, and the stringers **112**, and thus provide ample strength to support the types of lading for which the car **10** is intended.

In addition to having their webs **94** welded to the underside of the bottom plate **56** of the center sill **26**, the crossbearers **90** are connected with the center sill **26** through gussets **114** which are in the form of tapered, hollow semicylinders, or half-pipes. As shown best in FIG. **7**, a pair of parallel upper margins **116** of each gusset **114** are welded to the underside of the bottom plate **56** of the center sill **26**, aligned opposite the side plates **76** of the center sill. A semicircular end face **118** of each gusset **114** is welded to the web **94** of a crossbearer **90**. Each gusset **114** is tapered to a shorter length further from the bottom plate **56**, near the central portion **96** of the crossbearer **90**, while the upper margins **116** are longer, to distribute loads from the crossbearer **90** over a significant length of the center sill **26**. The gussets **114** may be formed of steel 5/16 inch thick, for example.

In order to facilitate installation of the stringers **102** and **112** during construction of the car, a short sleeve **120** fit around one end of each stringer **102** or **112**, which is somewhat shorter than the space between crossbearer webs **94** where the stringer fits. The sleeves **120** are welded to the stringers, the underside of the floor plate **54** or bottom plate **56**, and the adjacent web **94**, while the remainder of each stringer **102** or **112** is welded in place tight against a web **94** at the opposite end of the stringer.

The resulting floor in the intermediate portion **50** is a significantly integrated structure incorporating the stringers **102** and **112** and the crossbearers **90**, which, in turn, are securely attached to the underside of the center sill **26**, through the web **94** and the gussets **114**. The portions of the bottom plate **56** which extend laterally beyond the side plates **76** of the center sill are supported between the crossbearers **90** by the attached stringers **102** and provide part of the cargo-carrying floor surface. The center sill **26** is thus reinforced by the floor structure just described, which serves as part of a wide bottom chord of the center beam whose columns **30**, **32** and **34** and diagonal members **36** extend upward to the top chord **28**.

The intermediate portion **50** of the car **10** preferably has a length **122**, established by the distance between the shear plates **66**, that is related to a multiple of the usual length of packages of goods which the car **10** is intended to carry. For example, the distance **122** may be 40 feet 6 inches, allowing five bundles of lumber or sheet of plywood each 8 feet long and 4 feet wide to fit in the intermediate portion **50** of the car between the shear plates **66** and below the height of the end portion floors **44**. The lading can thus be conveniently stacked on the depressed floor to a height equal to the height difference **62**, above which the lading of the car can extend over a greater length established by the distance between the bulkheads **20** and **22**, which is also preferably related to the usual cargo package size.

In the intermediate portion **50** of the car **10**, the depth **125** of the center sill **26**, established by the vertical height of the side plates **76**, is greater than in the end portions **42** of the car **10**. The center sill **26** is also narrower in the intermediate portion **50** than in the end portions **42**. Because the floor **44** of each end portion **42** is located above the stub end portions **124** of the center sill **26**, and because it is desirable for the car to

rest as low as practical on the trucks **14**, in order to minimize the height of the center of gravity of the car **10**, the stub end portions **124** are wider but shallower, as may be seen clearly in FIGS. **3** and **5** and by comparison between FIGS. **8** and **9**.

A sloping portion **126** of the bottom plate of each stub end portion **124** of the center sill **26** is welded to the bottom plate **56** beneath the reinforced shear plates **66**, as shown best in FIG. **5**. The sloping portion **126** and the horizontal portion **128** of the bottom plate of the stub end portions **124**, shown also in FIG. **9**, have a greater thickness than the bottom plate **56**, and may be, for example, ¾ inch thick. A top plate **129** of the stub end portions **124** of the center sill **26** is of relatively thick plate, for example, ½ inch thick.

Interconnected with the stub end portions **124** of the center sill **26** in each of the end portions **42** is a respective body bolster **130** which rests atop the wheeled truck **14** that supports that end of the car body **12**. As shown in FIG. **9**, a center bearing **132** is associated with the bottom of the body bolster **130**.

A pair of lateral arms **134** extend laterally outward and diagonally upward from the stub end portion **124** of the center sill to the upper or end portion side sills **48**, and each is welded to the respective side sill **48**. Each arm **134** includes a pair of upright transverse plates, or side plates **136**, tapered and extending outwardly from the center sill, parallel with each other and spaced apart from each other in a direction parallel with the length of the car **10**. The side plates **136** are interconnected with each other by a bottom plate **138** and a top plate **140** that extend longitudinally of the car body **12** beyond each side plate **136** so that each arm **134** has the form of a tapered flanged box beam. The bottom plate **128** of the stub end portion **124** of the center sill **26** extends laterally outward beyond each of its side plates **142** for a distance of about one-half the width **144** of the stub end portion **124**, and so the bottom plate **138** of each arm **134** is welded to an adjacent portion of the lateral margin of the bottom plate **128** of the stub end portion **124**.

A tie plate **146** which may be ½ inch thick extends along a portion of each bottom plate **138** and the bottom plate **128**, providing an additional thickness of material to carry the loads encountered where the arms **134** are interconnected with the stub end portion **124**, and gussets **148** provide additional reinforcement along the margins of the bottom plate **128**.

Mounted atop each of the arms **134** of the body bolster **130** is a floor support riser **150** in the form of a downwardly open U-shaped channel that provides a flat horizontal top face **152** and has sides aligned with the side plates **136**.

A side bearing foundation **153** is integrated with the lower side of each arm **134**, and extends downward beneath the bottom plate **138**, as may be seen in FIGS. **2**, **5** and **9**.

A pair of longitudinally extending floor support stringers **154**, preferably in the form of channels similar to the stringers **102** and **112**, are mounted atop the horizontal top face **152**, and are welded to the underside of the end portion floor sheet **46** on each lateral side of the car body **12**. The stringers **154** extend longitudinally from the reinforcement channel **68** supporting the shear plate **66** to the end sill **156** located beneath the bulkhead **20**, in order to provide support for the floor sheets **46**, which are preferably of 11 gauge sheet steel (0.1196 inch thick).

As shown in FIG. **10**, the stringers **154** are also supported between the body bolster **130** and the end sill **156** by a transversely extending support member **158**, preferably in the form of a channel of bent sheet steel thick and having horizontal flanges and a vertical web. The support members **158** each extend from a side sill **48** laterally inward to a support plate **160** welded to and extending upward from a respective side plate **142** of the stub end portion **124** of the center sill **26**, as shown in FIG. **10**.

Each stub end portion **124** houses appropriate gear to support a conventional coupler at each end **16** or **18** of the car body **12**.

Each bulkhead **20** or **22** extends upwardly above the respective end sill **156**, and preferably includes a closed section central column **162** fabricated of a pair of channels connected by flat plates, and a pair of side columns **164** in the form of outwardly facing channels, with a pair of face plates **166** on each bulkhead **20** or **22** facing toward the opposite end **16** or **18** of the car body. Each face plate **166** is reinforced by horizontal channels **168** welded to the outboard side of each bulkhead **20** and **22** between the central column **162** and each column **164**, as shown in FIG. **2**.

Referring to FIGS. **13**, **14**, and **15**, the cargo **500** of the center beam railroad car **10** is stacked on the floor **44** of the car on both sides of the center beam **24**. Additional bundles of cargo **501** may be stacked above the center beam **24**. If a plurality of bundles **501** are stacked across the car above the center beam **24**, the bundles are typically stacked to abut along their inboard sides to aid in stabilizing the load. Straps or cables **502** run over the cargo to cargo tie-down strap spools **60** at the periphery of either side of the car. When the straps or cables **502** are tightened, the stacked cargo **500** is pulled toward the center of the car **10** and the upper inboard corner of the cargo stack comes into contact with the lateral face **93***a* of the top chord **28** of the center beam **24** which resists further lateral displacement of the cargo.

The internal structure of top chord **28** of the center beam **24** is typically a hollow rectangular beam or tube **29**, for example, a section of 10"×10" square steel tubing of ½-inch wall thickness having a top wall **508**, a bottom wall **510** and lateral walls **512**. The cargo is typically covered by a protective plastic sheet **514** that becomes trapped between the goods **516** and the lateral face **93***a* of the top chord **28** when the straps or cables binding the cargo are tightened. Typically, center beam rail cars are not enclosed and the plastic sheet **514** is intended to protect the goods **516** from exposure to moisture, dirt, and sand that is encountered during transit.

When the car is in motion it vibrates and changes speed and direction and the cargo moves relative to the car's structure. The upper corner of the stacked cargo **500** in contact with the lateral face **93***a* of the top chord **28** of the center beam **24** moves relative to the lateral face in directions generally parallel to the face. While the protective sheeting **514** can be damaged by sharp edges of various elements of the center beam structure, the present inventors concluded that friction between the protective sheeting **514** and the lateral face **93***a* of the top chord **28** can cause the sheeting to be abraded, eventually exposing the goods **516** to the elements. The goods **516** transported by center beam rail cars are often wood products and the value of the cargo can be substantially reduced by the presence of dirt and sand embedded in the surface of the wood or by discoloration of the wood by mold or mildew following exposure to moisture.

To protect the sheeting **514** from wear and, thereby, to protect the goods **516** from the elements, the lateral faces **93***a* of the top chord **28** of the center beam **24** comprise a material presenting a smooth surface and a low coefficient of friction to the protective sheeting **514** covering the goods **516**. The lateral surface **93***a* of the top chord **28** may be constructed of any material exhibiting a relatively low coefficient of friction with the protective cargo sheeting which commonly comprises polyethylene but which may comprise another com-

mon plastic. One suitable material for the lateral face **93***a* of the top chord is an ultra-high molecular weight polyethylene.

In one embodiment, the lateral face **93***a* of the top chord **28** is an outer surface of a top chord cover **520** that is interposed between the lateral wall **512** of the top chord tube **29** and the plastic sheeting **514** covering the goods **516**. Lateral displacement of the cargo **500** is resisted by the compression of the top chord cover **520** between the cargo **500** and the lateral wall **512** of the top chord tube **29**. The top chord cover **520** for the top chord **28** is selectively removable to permit the cover to be replaced when worn or damaged and to permit covers comprising materials that are particularly suited to certain cargoes or cargo coverings to be installed when appropriate.

In a first embodiment, the top chord cover **520** comprises, generally, a channel-shaped cross-section having a channel base **522** having one side that forms the lateral face **93***a* and covering substantially all of the lateral wall **512** of the top chord tube **29**. The top chord cover **520** also comprises a top leg **524** and a bottom leg **526** that fit over portions of the top **508** and bottom **510** walls of the top chord tube **29**. The top chord cover **520** is selectively affixable to the top chord tube **29** and clamped to the top chord tube by nuts **527** that engage studs **528** welded to the top wall **508** and bottom wall **510** of the tube. Clamping the top chord cover **520** to the top wall **508** and bottom wall **510** of the top chord tube **29** presents a smooth, low friction, lateral face **93***a* of the top chord **28** for contact with the cargo **500**.

Referring to FIG. **16**, in another embodiment, a top chord cover **600** is adhered to a lateral wall **512** of the top chord tube **29** with an adhesive **602** compatible with the material of the top chord cover and the top chord tube. The top chord cover **600** may be selectively removed from the lateral wall **512** by breaking the adhesive joint.

Referring to FIGS. **17** and **18**, in still another embodiment, the top chord cover **650** comprises, generally, a channel of C-shaped cross-section with a pair of sides **652** each having one surface that forms the lateral face **93***a* and a second surface supported by and substantially coextensive with the outer surface of the lateral wall **512** of the top chord tube **29**. The top chord cover **650** also comprises a web **654** that connects the sides **652** and which extends substantially coplanar to the top wall **508** of the top chord tube **29** when the cover is installed. A bottom leg **656** extends laterally from each of the sides **652**, fitting over the corner formed by the bottom surface and the lateral wall **512** and extending over a portion of the bottom surface of the top chord tube **29** in an interfering relationship. The web **654** and the sides **652** of the top chord cover **650** are sufficiently flexible to permit installation of the top chord cover **650** by separating the bottom legs **656** to create a gap sufficiently wide to permit the width of the top chord tube **29** to pass between the ends of the legs. When released, the top chord cover **650** returns to its original shape substantially encircling the perimeter of the cross-section of the top chord tube **29**. Additional security for the top chord cover **650** is provided by nuts **527** engaging studs **528** welded to the bottom wall **510** and clamping the legs **656** to the bottom of the top chord tube **29**. The top chord cover **650** provides a smooth upper surface eliminating traps for dirt and moisture, reduces the number of parts to simplify installation and repair, and presents a smooth, low friction, top chord lateral face **93***a* for contact with the cargo **500**.

The railroad car **10** with the structure described above is amply strong yet lighter in tare weight than previously known railroad freight cars of depressed floor center beam construction, and thus is potentially cheaper to construct and to operate.

The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

What is claimed is:

1. A freight-carrying railroad car having a body having a pair of opposite sides, a length, and a pair of opposite ends each supported on a wheeled truck, said body comprising:

(a) a center sill extending longitudinally along said body;

(b) a floor extending laterally from said center sill on each of said opposite sides of said car body;

(c) wherein an intermediate portion of said center sill located between said opposite ends of said body includes a pair of upright side plates spaced laterally apart from each other by a first distance therebetween, a horizontal top plate spanning said first distance and interconnecting said upright side plates with each other, and a horizontal bottom plate interconnecting said upright side plates with each other and extending laterally outward beyond each of said upright side plates;

(d) wherein said floor includes a floor sheet extending outboard laterally beyond said bottom plate, a portion of said bottom plate of said center sill being exposed to cargo and acting as an inboard portion of said floor, said portion exposed to cargo extending laterally outward beyond each of said upright side plates by a second distance that is at least half of said first distance; and

(e) wherein said horizontal top plate is thicker than said horizontal bottom plate, whereby said bottom plate aids in providing stiffness of the center sill to resist lateral bending and said floor sheets need not extend to a respective one of said upright side plates and said car body is thereby reduced in weight.

2. The freight-carrying railroad car of claim **1** wherein at least one of said side plates is exposed to being in contact with cargo.

3. The freight-carrying railroad car of claim **1** wherein said portion of said bottom plate exposed to cargo extends laterally outward beyond each of said upright side plates by a third distance that is at least as great as said first distance.

4. The freight-carrying railroad car of claim **1** wherein said portion of said bottom plate exposed to cargo extends laterally outward beyond each of said upright side plates by a third distance that is greater than said first distance.

5. In a freight-carrying center-beam railroad car having a pair of opposite sides, a length, and a pair of opposite ends, a car body comprising:

(a) a center beam extending longitudinally along said body, the center beam including a center sill extending longitudinally along said body, a top chord parallel with and spaced upwardly above and apart from said center sill, and a plurality of upright members each extending between said center sill and said top chord, said center sill, upright members and top chord all having respective lateral faces, and said upright members being attached to said center sill and said top chord in such a manner that the lateral faces of the center sill, top chord, and upright members are coplanar; and

(b) a cargo-supporting floor extending laterally from said center sill on each of said opposite sides of said car body, said cargo-supporting floor being located at a height exposing an intermediate portion of said center sill to

being in contact with cargo and comprising a horizontal bottom plate of said center sill arranged for supportive contact with said cargo;

(c) wherein said intermediate portion of said center sill located between said opposite ends of said body includes a pair of upright side plates spaced laterally apart from each other by a first distance therebetween, a horizontal top plate spanning said first distance and interconnecting said upright side plates with each other, and said horizontal bottom plate interconnecting said upright side plates with each other and extending laterally outward beyond each of said upright side plates;

(d) wherein said cargo-supporting floor includes a floor sheet extending outboard laterally beyond said horizontal bottom plate, a portion of said bottom plate of said center sill being exposed to cargo and acting as an inboard portion of said floor, said portion exposed to cargo extending laterally outward beyond each of said upright side plates by a second distance that is at least half of said first distance; and

(e) wherein said horizontal top plate is thicker than said horizontal bottom plate, whereby said bottom plate aids in providing stiffness of the center sill to resist lateral bending and said floor sheets need not extend to a respective one of said upright side plates and said car body is thereby reduced in weight.

6. The freight-carrying railroad car of claim **5** wherein said portion of said bottom plate exposed to cargo extends laterally beyond each of said upright side plates by a third distance that is at least as great as said first distance.

7. The freight-carrying railroad car of claim **5** wherein said portion of said bottom plate exposed to cargo extends laterally beyond each of said upright side plates by a third distance that is greater than said first distance.

8. In a freight-carrying center-beam railroad car having a pair of opposite sides, a length, and a pair of opposite ends, a car body comprising:

(a) a center beam extending longitudinally along said body and having a pair of opposite sides, the center beam including a center sill extending longitudinally along said body, a top chord parallel with and spaced upwardly above and apart from said center sill, and a plurality of upright members each extending between said center sill and said top chord, said center sill, upright members and top chord all having respective laterally outer faces on at least one of said opposite sides, and said upright members being attached to said center sill and said top chord in such a manner that the laterally outer faces of the center sill, top chord, and upright members are coplanar and present a continuous planar surface free of laterally outward projections wherever said center beam is exposed to being in contact with cargo on said at least one of said opposite sides;

(b) a cargo-supporting floor extending laterally from said center sill on each of said opposite sides of said car body;

(c) wherein an intermediate portion of said center sill located between said opposite ends of said body includes a pair of upright side plates spaced laterally apart from each other, the outer surfaces of said upright side plates defining the laterally outer faces of said center sill in said intermediate portion of said center sill, and said cargo-supporting floor in said intermediate portion being located at a height exposing said upright side plate outer surfaces to being in contact with cargo; and

(d) wherein said upright side plate outer surfaces on at least one of said opposite sides of said center sill in said intermediate portion of said center sill permit cargo within said intermediate portion to sit flush against said continuous planar surface on said at least one of said opposite sides.

9. The car body of claim **8**, wherein cargo sitting flush against and in contact with said continuous planar surface is not exposed to edges capable of damaging the cargo or tearing a protective covering associated therewith.

10. The car body of claim **9**, wherein said cargo comprises lumber or plywood and is covered by a protective covering suitably designed to protect the lumber or plywood from moisture or abrasive damage, and wherein said top chord is free of any cargo-facing edges and free of any surfaces that are non-coplanar with said continuous planar surface and are capable of tearing said protective covering when said cargo is transported in said car body.

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